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GEORGICAL

ESSAYS:

BY

A. HUNTER, M.D. F.R.S.L. & E.

NISI UTILE EST QUOD FACIMUS STULTA EST GLORIA. *Phæd.*

VOLUME V.

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PREFACE.

In all the arts, and in agriculture in particular, the foundation must be laid in a faithful collection of facts. The steps of nature must be traced with diligence, marked with care, and recorded with integrity, before any opinion can be formed of her plan in promoting the vegetation of plants. All reasoning, and all conclusions, drawn from the operations of nature, especially on this subject, ought to rest ultimately upon facts. The practical farmer following these, is led forward on safe ground, making similar trials with confidence; and if his soil be of the same nature, his climate of the same temperature, and his means of improvement equally powerful, his endeavours will generally be crowned with succeſs.

While the speculative farmer, who follows the plausible system of a theorist, and, consequently, who builds on the "baseleſs fabric of a vision," is ruined by imaginary schemes, the practical farmer, who studies with care the conduct of others, and who matures and establishes their practices by his own experience, is, in the end, sure to enjoy the well-earned reward of his industry. The former attaches himself to theories. The latter admits of no principles, unconfirmed by experience.

The celebrated Spallanzani justly observes, " that when we interrogate nature, we muſt be divested of all prejudice which obscures the fair face of truth; and with an amiable indifference, we ought to judge equally of ourselves as we do of others. If, on the contrary, we are prepoſseſsed with wishes, distrust, and doubts, we shall be disposed to think well of experiments from the side favouring our desire, and not from that which is adverse to it. Our opinions will consequently be incorrect; and instead of adding useful facts to philosophy, we shall increase the number of errors."

From the succeſs of my former volumes, I am encouraged to prosecute my original plan, and as it is impoſsible for an author who conducts a miscellaneous work, to give equal satisfaction to his readers, I have only to request the favour that they will continue to grant me their generous indulgence for the insertion of any papers that may not fully meet with their approbation. Some persons have expreſsed a wish to have all the papers claſsed together, under their respective heads, but in a periodical work containing many original papers, delivered at different times, such a disposition is impoſsible. When the work is brought to its final termination, an attempt of that kind would be very practicable.

A. HUNTER.

YORK, MARCH 21, 1804.

GEORGICAL ESSAYS.

ESSAY I.

On the Improvement of Agriculture.

A Noble spirit, for making improvements in Agriculture, hath lately gone through this nation, for which posterity will thank the present age in terms of the highest approbation. The principles on which those improvements have been conducted are as judicious as the subject is important: and it is highly probable, that many good effects will take place in every part of the kingdom.

Agriculture has been considered of national importance by the most discerning part of mankind in all ages.

Every civilized nation, at one period or other, has been convinced of its intrinsic excellence; and the wisest men, of every age and country, have unitedly bestowed the highest encomiums on it. In the present times we have the satisfaction of seeing, that the noble, the wise, and the learned, do not think it beneath them to rescue it from that obscurity in which it had long been involved, and to bring it forward to public view, under the sanction of their own practice.

Julius Cæsar, speaking of the manners of the Germans in their rude uncultivated state, makes the following observations:

‘ Agriculture they disregard; their diet consisting chiefly in milk, cheese, and flesh: for ‘ none of them have any certain quantity of ‘ ground, or even country, which they can call ‘ their own. But their magistrates and chiefs ‘ allot, for one year only, among the scattered ‘ inhabitants and their tribes who aſsociate ‘ together, such a portion of land, and in such ‘ a district, as they think proper; and then ‘ oblige them to reside at some other place ‘ for another year. They aſsign several reasons for this conduct:—That the people ‘ might not be induced to exchange the study ‘ of war for that of husbandry;—that they 'might not wish to increase their settlements, 'and so the stronger expel the weaker from 'their poſseſsions; that they might not erect 'any buildings, except barely to keep out 'heat and cold, &c.

A country will be cultivated only in proportion as its inhabitants advance in civilization. Nations will not begin to civilize themselves, till they cease migrating from place to place; neither will a man attempt to cultivate any spot, till he can say *this is mine*. But when men unite together for mutual protection and advantage, and settle in one place, the cultivation of that spot immediately becomes neceſsary, that it may supply them with the conveniences of life. Property, therefore, must be gained and defined, settled and secured. These are circumstances on which the advancement, if not the very existence, of Agriculture depends.

But these are not all. There are two others of equal importance to its improvement and prosperity: the one is, the fruit of a man's labour must be secured to him: the other, that as the wants of men increase in consequence of civilization, the earth must be encouraged to yield proportionable supplies.

This, however, can be effected only so far as the powers of the human mind are enlarged in consequence of civilization. Huſbandry can rise no higher than the knowledge of those who are engaged in it will permit. It hath been indebted for its principal improvements, not only to the natural abilities of the cultivator, but to an education formed upon an acquaintance with other branches of science.

Whenever any of the above circumstances fail, Agriculture must feel a stagnation;—in proportion as they are regarded, will be the progreſs made in it, and its ſucceſs.

This appears to be the case in fact; for these circumstances, especially the last of them, were not heretofore sufficiently attended to by this nation; which will fully account for the defective state of husbandry in former times, its slow progreſs, and its present improvements; while it also points out the most probable method of carrying it still nearer to perfection.

If we expect to find Agriculture in a thriving state before the Reformation, we shall be diſappointed: it was indeed considered of importance; but the fruit of a man's labour was not secured to him; and the nation was immersed in groſs ignorance. The feudal constitution, the military disposition of the people, and the tyranny of popish ecclesiastics, were unfriendly to skilful and vigorous cultivation.

There was no great encouragement for the owners of estates to exert themselves in the cultivation of them, while others were to reap the fruit of their labours: this was, therefore, left to their meaner vaſsals, whose spirits were sufficiently humbled to submit to almost any imposition. The same reason which is to be given for the uncultivated state of Italy, though in itself the garden of the world, may be aſsigned for the general disgrace into which rural economics had fallen in England, till the time of the Reformation. For one may venture to pronounce, without prejudice, that agriculture, *cæteris paribus*, will always flourish most in free governments and Protestant countries.

In such a situation of things, when agriculture was, as it were, banished into deserts, and in every respect took up its residence among mountains and vales, where knowledge had made small progreſs;—when the mind of the peasant was not enlightened by the rays of science, when he tilled the earth merely by the labour of his hands and the sweat of his brow, without any fixed principles; it is not to be supposed, that any considerable improvement could be made by him.

Nor was this all. Admitting that the principles of vegetation had been accurately delineated to his view, or experiments founded thereon proposed, it was not for him to investigate the one, or practise the other, while ecclesiastical tyranny prevailed, and he knew that the priesthood would reap the far greater part of the fruits resulting from his labour.

Tyranny over the mind will ever retard the progreſs of every kind of knowledge.

But even after the Reformation, although many of the arts and sciences were cultivated with peculiar spirit, agriculture did not receive encouragement proportioned to its great importance. Every thing cannot be attended to at one time.

A new world had been discovered, which opened the brightest prospects to these kingdoms, and the attention of England was fixed chiefly on trade and commerce. This circumstance, which for a while appeared to be a principal impediment to husbandry, and was the cause of little attention being paid to Fitzherbert*, proved in the event one of its principal promoters. By commerce, the various productions of different parts of the earth have been brought into this kingdom, and intrusted to the care of the skilful botanist and gardener; who, having naturalized them to this climate, commit them to the care of the husbandman. In return, agriculture has ever since been aſsisting commerce in the increase of corn, hemp, flax, madder, &c.; and in proportion as both have been attended to, it is evident they have mutually aſsisted each other.

But as improvements prevailed, the importance of husbandry, in a national view, became daily more and more conspicuous;—the disadvantages and impediments it met with, under the management of common farmers, began likewise to appear. The weeds sprang up with the wheat, and skill was wanting to prevent this evil.

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* The father of English Husbandry: made Judge of the Common-Pleas, about the year 1524. His book of husbandry was printed in 1534, after forty years attention to the subject, in his receſses between the Terms.

To check these weeds, by enlarging the views of those intended for the profeſsion of agriculture, was the noble attempt of the great Milton; who recommended a school, in which rural economics were to bear a principal part in his system of education. His pupils were to read the works of Cato, Varro, Columella, &c. on agriculture. But unhappily, his loſs of sight prevented him from realizing in practice what he had so judiciously adopted in theory.

That Evelyn, one of the most useful men of the age in which he lived, entertained the same sentiments as Milton, appears from the preface to his Silva. To him the nation is now, and will be for many years to come, greatly indebted for the strength of her navy.

To form a glorious triumvirate, we can invite the very modest and sensible Mr. Cowley, in support of the same plan. He recommended a college to be erected in each University, and the appointment of profeſsors for the instructing of young persons in the principles and practice of this useful employment.

But, as it is always the fate of the most useful designs to meet with difficulties at the beginning, agriculture itself began, soon after, to fall from its flourishing state into national disregard. This, however, is easily accounted for.

I have laid it down as a general rule, that civilization encourages husbandry: yet it is poſsible that rural economics may be impeded by this very civilization, unleſs it be well regulated. A nation may be civilized to so high a degree of refinement, as that the politer part of its inhabitants will aſsociate in cities and towns, and attend to nothing but pleasure and the fine arts. The consequence is, that agriculture will be nearly in the same predicament as it was before the commencement of civilization.

In such a state of false refinement, the cultivation of land will be considered as beneath the notice of the rich and the learned, and be left to the ruder part of the people.

Such was the state of this nation in the reign of that gay Prince, Charles II.; and could any thing else be expected but that agriculture must severely suffer, in an age so deeply immersed in luxury, pride, and diſsipation? especially if it be considered that the persons who paid the closest attention to it, had "crept into the confiscated estates of the nobility, gentry, and clergy," and were many of them originally in very inferior stations.

At that period, the maxims of the celebrated Bacon, the example of Milton, the efforts of the Royal Society, the proposal of Cowley, the complaint of Evelyn, and his just observations on the neceſsity of an enlarged education, in order to improve the lands of England, were exhibited in vain.

It was to little purpose that the ministry, after the Restoration, permitted the exportation of wheat; it increased tillage, but did not improve the mode of culture, or reconcile the nobility and gentry "to what had been "the object and care of mean and despised "persons."

Thus Agriculture fell into disrepute, and was driven back again to the mountains and vales, where Fitzherbert firſt found her; with this difference only in her circumstances, that she might be more easily recalled by the writings which were extant, whenever the nation should be restored to its characteristical sedateneſs.

Whenever any scheme of real utility and national importance is formed by men of genius and true patriotism, the worst kind of impediment it can meet with is, that of national supineneſs and inattention. If it be not actually opposed, it is not promoted; and if people do not reflect on it, they cannot see its importance.

Nothing, however, can totally check the vigour of great minds. Evelyn, in the midst of this general indifference, published, in the year 1675, his *Terra*, or a *Philosophical Discourse on Earth;* which, with the aſsistance of former publications, began to open the eyes of his countrymen to their true interests, to the dignity of his subject, and the neceſsity of more than a superficial knowledge, in order to make improvements in it.

The next writer we shall mention is, Lord Molesworth, who, in his *Considerations for the promoting of Agriculture, and employing the poor*, makes the following judicious remarks, quite in point to the purport of this eſsay. "As to Agriculture, I would humbly propose "that a school for husbandry should be established in every county, wherein a master "well skilled in Agriculture should teach at a "fixed yearly salary: and that Tuſser's old "book of husbandry should be taught the "boys to read, to copy, and get by heart; for "which purpose it might be reprinted."

Complaints of the impracticability of illiterate peasants making any considerable improvements in rural economics, and the neceſsity of aſsisting them, began now to be as general as just; being founded on facts and sad experience, which were pregnant with many pernicious consequences. It was clearly seen, that they could not deviate from the beaten track; that they were not capable of reflecting on the nourishment of plants, in order to increase vegetable food, by judicious and frequent ploughings, and suitable manures; of introducing new claſses of vegetables, however advantageous; or of making any experiments on scientific principles; especially as they knew, that if these failed, they should risk the failure of their rent. On all accounts, therefore, they must continue in the course marked out by their ancestors, however defective and injudicious.

These imperfections having been long observed and lamented, several gentlemen of public spirit (the leader of whom was the famous Tull) took their estates into their own hands, and cultivated them with—' spirit, taste, and sense,'—by regulating the course of crops according to the nature of the soil—by banishing wasteful fallows—by destroying weeds—by stirring and pulverizing the earth while a crop was growing, and thereby preparing it for the immediate reception of a succeeding one—by introducing new plants for the better support of man and beast, in winter as well as summer, &c. But, unhappily, these capital improvements remained for a long time within the circle of those farms, where they originated, or those counties where such public-spirited gentlemen had set the example by their own practice. These modes of cultivation were novel; on this account they were slighted, if not derided, by the genetration of the common farmers. The principles on which such culture was founded, were above their comprehension: it must therefore necessarily be, as they fancied it, too expensive for them to run the risk of practising.

This circumstance gave rise to another plan, in itself most honourable and benevolent, namely, the establishment of a Society in London for the encouragement of Agriculture, &c. which, by bestowing large premiums for the greatest crops on given quantities of ground, effectually secured the farmer under any risk he might run. It was naturally imagined this would have answered the end proposed. But if we may determine from the register of the persons to whom premiums have been adjudged, most of the candidates have been far above the rank of common farmers.

However short and defective the above account of the state of Agriculture in this kingdom at different periods may be; yet I hope I have made it appear—that it is much indebted for its present improvement to learning and civilization—that whatever deficiencies it still labours under, they are owing to a defect in the education of farmers in general—

that it hath a close connexion with other branches of science—that learning and experiments must go hand in hand—that the proposals of those sensible and learned men above quoted, for establishing schools of agriculture, were founded on enlarged views, substantial grounds, and the greatest propriety—and that the little attention which has been paid thereto can be attributed to nothing else but certain temporary circumstances, which retard improvements of one kind or other in every age.

Agricultural Societies were not established when those gentlemen wrote: and it can hardly be supposed that, whatever propriety or utility there might have been in their plan, they alone could suddenly turn the regard of the nation to a ſubject of which it had then ſcarce any idea.—The case is now otherwise. Under the fostering influence of the Board of Agriculture, agriculture hath arisen, like a star of the first magnitude, in our hemiſphere; and many of the wiseſt men of our nation, of all ranks, are continually turning their eyes towards it.

Let this spirit continue to prevail; let agriculture be studied by gentlemen of landed property, on philosophic principles; let it be taught to their tenants; and the happy consequence will soon be apparent through this island.

ESSAY II.

On the Surface of the Earth.

When we take a slight survey of the surface of our globe, a thousand objects offer themselves, which, though long known, yet still demand our curiosity. The most obvious beauty that every where strikes the eye is the verdant covering of the earth, which is formed by an happy mixture of herbs and trees of various magnitudes and uses. It has been often remarked that no colour refreshes the sight so well as green; and it may be added, as a further proof of the aſsertion, that the inhabitants of those places where the fields are continually white with snow, generally become blind long before the usual course of nature.

This advantage, which arises from the verdure of the fields, is not a little improved by their agreeable inequalities. There is scarce two natural landscapes that offer prospects entirely resembling each other; their risings and depreſsions, their hills and valleys, are never entirely the same, but always offer something new to entertain and refresh the imagination.

But to increase the beauties of the face of nature, the landscape is enlivened by springs and lakes, and intersected by rivulets. These lend a brightneſs to the prospect; give motion and coolneſs to the air; and, what is much more important, furnish health and subsistence to animated nature.

Such are the most obvious and tranquil objects that every where offer: but there are others of a more awful and magnificent kind; the mountain rising above the clouds, and topt with snow; the river pouring down its sides, increasing as it runs, and losing itself, at last, in the ocean; the ocean spreading its immense sheet of waters over one half of the globe, swelling and subsiding at well-known intervals, and forming a communication between the most distant parts of the earth.

If we leave those objects that seem to be natural to our earth, and keep the same constant tenor, we are presented with the great irregularities of nature. The burning mountain; the abrupt precipice; the unfathomable cavern; the headlong cataract; and the rapid whirlpool.

If we carry our curiosity a little further, and descend to the objects immediately below the surface of the globe, we shall there find wonders still as amazing. We first perceive the earth for the most part lying in regular beds or layers, every bed growing thicker in proportion as it lies deeper, and its contents more compact and heavy. We shall find, almost wherever we make our subterranean inquiry, an amazing number of shells that once belonged to aquatic animals. Here and there, at a distance from the sea, beds of oyster-shells, several yards thick, and many miles over; sometimes testaceous substances of various kinds on the tops of mountains, and often in the heart of the hardest marble. These, which are dug up by the peasants, in every country, are regarded with little curiosity; for being so very common, they are considered as substances entirely terrene. But it is otherwise with the inquirer after nature, who finds them, not only in shape but in substance, every way resembling those that are bred in the sea; and he, therefore, is at a loſs to account for their removal.

Yet not one part of nature alone, but all her productions and varieties, become the object of the speculative man's inquiry; he takes different views of nature from the inattentive spectator; and scarce an appearance, how common soever, but affords matter for his contemplation: he inquires how and why the surface of the earth has come to have those risings and depreſsions which most men call natural; he demands in what manner the mountains were formed, and in what consist their uses; he asks from whence springs arise; and how rivers flow round the convexity of the globe; he enters into an examination of the ebbings and flowings and the other wonders of the deep; he acquaints himself with the irregularities of nature, and he will endeavour to investigate their causes; by which at least, he will become better versed in their history. The internal structure of the globe becomes an object of his curiosity; and, although his inquiries can fathom but a very little way, yet, if poſseſsed with a spirit of theory, his imagination will supply the rest. He will endeavour to account for the situation of the marine foſsils that are found in the earth, and for the appearance of the different beds of which it is composed. These have been the inquiries that have splendidly employed many of the philosophers of the last and present age; and, to a certain degree, they must be serviceable. But the worst of it is, that, as speculations amuse the writer more than facts, they may be often carried to an extravagant length; and that time may be spent in reasoning upon nature, which might be more usefully employed in writing her history.

Too much speculation in natural history is certainly wrong; but there is a defect of an opposite nature that does much more prejudice; namely, that of silencing all inquiry, by alleging the benefits we receive from a thing, instead of investigating the cause of its production. If I inquire how a mountain came to be made, such a reasoner, enumerating its benefits, answers, because God knew it would be useful. If I demand the cause of an earthquake, he finds some good produced by it, and alleges that as the cause of its explosion. Thus such an inquirer has constantly some ready reason for every appearance in nature, which serves to give splendour to his declamation: every thing about him is, on some account or other, declared to be good; and he thinks it presumption to scrutinize into its defects, or to endeavour to imagine how it might be better. Such persons, and there are many such, add very little to the advancement of knowledge; and it is finely remarked by Bacon, "that the investigation of final causes is a barren study; and, like a virgin dedicated to the Deity, brings forth nothing." In fact, those men who want to compel every appearance and every irregularity in nature into our service, and expatiate on their benefits, combat that very morality which they would seem to promote. God has permitted thousands of natural evils to exist in the world, because it is by their intervention

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that man is capable of moral evil; and he has permitted that we should be subject to moral evil, that we might do something to deserve eternal happineſs by showing that we had rectitude to avoid it.

ESSAY III.

On the Agriculture of the Netherlands.

THE characteristic features of the Belgic peasants are, *industry*, great *economy*, and a strong *attachment* to the methods and customs of their predeceſsors.

They are not, perhaps, so laborious as the peasants of some other countries, with regard to the quantity of labour they despatch; but they are inferior to few in their constancy at it, and in the unwearied patience wherewith they endeavour to overcome the difficulties that arise in their way. No part of their time is spent in idleneſs; nor do they let escape any opportunity of gain which they can lay hold of. No object of this kind, be it ever so trifling, is to them indifferent; and though they be apparently dull and heavy in their behaviour, yet none are more clear-sighted wherever their interest is concerned, or sharper in laying hold of what is to their advantage. They show themselves, however, rather ſlow, in conceiving what makes against them.

They live with great economy, both as to diet, clothes, and lodging. They are utter strangers to the ease and elegance of English farmers. Their food is chiefly milk, soup, and vegetables; a piece of bacon, with their greens or roots, is their principal animal food for the greatest part of the year. At their feasts and kermeſses, a ham and a kind of pancakes called woffels, are their chief delicacies. Their drink is small beer, and a glaſs of cheap gin in the morning: wine is a great rarity with them.

As to their clothing, it is certainly warm and comfortable, though coarse and rustic in its form. On Sundays and holidays, when they put on their best attire, if it may be judged of by its fashion and shape, it may be supposed to have been worn by their grandfathers, so different it is from that of the towns in their neighbourhood.

Their dwellings have a particular form throughout a great part of the country The dwelling house makes one side of the farm-yard; it is of three heights, one lower than the other, but joining together: two other sides are occupied by stables, cow-houses, and barns; the fourth side is the entrance, and railed in. The whole space within, except a narrow path of stones along the sides of the buildings, and of no easy paſsage, is the receptacle of dung and all sorts of manure, whereby the whole building is rendered dirty and offensive to the smell; but custom makes them insensible of it. The corn and hay-stacks are without, behind the barns.

Few people are more attached to their customs and practices than the Belgic peasants. They seldom change their methods of Agriculture, being persuaded that their forefathers were as wise and knowing as themselves, and that what they did, is the best themselves can do. Whatever may be judged of their manner of living, and of the form of their dwellings (in which, however, they are as contented and happy as the most elegant English farmer,) it will easily be acknowledged by those thoroughly acquainted with the Flemish Agriculture, that their practices are far from being either bad or irrational: on the contrary, it seems that long experience has so well succeeded in adapting these to the nature of the soil, that it would be hard to do any thing better. During the many years I was at the head of an establishment which had many farms in property, and desirous to have them cultivated to the best advantage, I tried what experiments I could for this purpose. The intelligent farmers whom I often consulted on these heads, gave me satisfactory reasons, why the methods they followed, were preferable to what I proposed doing; and also why this would not succeed, as it proved in effect. The general result which I have been able to form, from what I know of the Flemish Agriculture, is, that they draw from their farms the best crops, and the most food for great and small cattle, fowl, &c. which the soil is capable of producing. The quantity thereof is certainly great, when compared to any extent of land in Germany, France, Spain, England, or any other country I am acquainted with. The comparison, if made with due knowledge and impartiality, will certainly turn in favour of Flemish Agriculture, whatever may be said in preference of the neatneſs and elegance of the methods used elsewhere, and of the usefulneſs of the new-invented machines employed therein.

What I have already said, is as much as this Eſsay will admit of, on the general nature of Belgic Agriculture. I shall now add a few words on the principles which the legislature follows with respect to it.

These are chiefly confined to the following heads: 1st, Permiſsion for exportation of corn in times of abundance, and restrictions in times of scarcity. 2dly, Ordinances for bringing corn to be sold at the markets, and for preventing it to be bought on the field, or at the farmer's. 3dly, Ordinances, in some provinces, for restraining the extent of farms, and prescribing a division of those of too great extent; also forbidding the destruction of farm houses, without rebuilding them.

With regard to the exportation of corn, the ordinances of government on that head are always temporary, and grounded on the reports made by the magistrates of the different districts, concerning the abundance or scarcity of corn, and specifying the quantity thereof: the great object being always to reserve in the country a quantity sufficient for home consumption, till the following crop be reaped and fit for use. When exportation is permitted, the quantity of it is usually limited, and the ports and paſsages specified by which it is permitted to go out; from whence regular reports are made, and when the quantity permitted is paſsed, these are shut. I know of no laws to prohibit the importation of corn at any time; but in times of scarcity (which seldom happen) it would come in duty free, or even with premiums. As corn is but a partial culture in the Low Countries, the surplus that is produced, above what is neceſsary for home consumption, is not so great as what might be supposed from so rich a soil. In common years this surplus is not more than one-tenth or one-eighth of the whole produce; but in abundant years it may go to one quarter, or even one half of the whole.

The ordinances for bringing corn to be sold at market, are generally eluded: the corn is bought at the farmer's, he brings it to market, exposes it, and his first answer is, that it is sold. This is often the cause of murmurs among the people; but I know of no remedy found for it, except the prohibition of all exportation, which takes place as soon as a real scarcity is felt; and this in its turn excites the murmurs of the farmers, who have seldom any other view than their private interest, and who always having corn enough for their own use, never see a scarcity in the country.

Laws for restraining the too great extent of farms, or a monopoly of land, are not general in the Low Countries: the province of Hainault has solicited and adopted them with great succeſs, as may be seen from the remarks given to me by the late Duke of Aremberg. Having treated this subject at length, by the expreſs desire of that judicious and well informed prince, in a paper printed in Vol. IV. of the Memoirs of the Imperial Academy of Bruſsels, I shall only add here, that the farms in Flanders and the other rich parts of the Low Countries, being seldom extensive, nay, for the most part small, no ground remains uncultivated; every part is put to the greatest profit: the farmers being at ease, but not rich, cannot keep back their crops; hence the markets are stocked constantly, not only with grain, but likewise with vegetables, milk, butter, eggs, fowls, hogs, &c. all which enter much more into consideration with them, than they can do in extensive farms. As this division of land into small farms, is a great means of increasing population, by encouraging marriage and industry, government constantly favours it; and expreſsly prohibits the letting farm houses fall to ruin, without rebuilding them, a thing many proprietors seek, for the sake of sparing the expense of rebuilding and repairs.

As to the methods of agriculture or the nature of crops, the government of the Low Countries takes no cognizance of them, but leaves every one to do what he thinks best; and certainly private interest and the love of gain are the best stimulants on this head, and seldom fail to excite each one to cultivate his ground in the manner, and with the productions, which he finds most profitable. Experience thereon is his only rule and guide.

The most universal land-measure in the Low Countries, is the bunder or bonier. In

Brabant and Hainault it contains 400 square perches, or roods of twenty feet long, so that the square rood contains 400 square feet, and the bunder 160,000. The rood varies in different parts, as does also the foot, which in general is leſs than the English one. On an average the bunder may be reckoned three English acres. In Flanders, land is usually measured by what is called a ghemet, a measure containing three hundred square roods; the rood being in some places twelve, in others fifteen, Flemish feet long: but in some parts of this province, the bunder or bonier is in use, containing 400 square roods, as in Brabant and Hainault; but the rood varies in different cantons, from ten to twenty feet in length. The bonier contains four journals of land.

In the rest of this Eſſay, I shall treat briefly of the methods of agriculture in different parts of Flanders, Brabant, and Hainault, distinguishing them according to the different nature of the soil, and confining myself to such practices as are generally established in each. As the difference of climate is insensible within these limits, I shall prefer the order which results from the soil, to that of locality, as the practices of husbandry, in an extent of flat country not exceeding one hundred miles any way, are determined in a great measure by the soil alone.

The different soils I shall speak of are the following:

1st, The sandy heath of the Campine of Brabant.

2d, The parts of Brabant contiguous to the Campine.

3d, The strong clayey soil of Wallon-Brabant, and the northern parts of Hainault.

4th, The soil of the middle region of Brabant, being a mixture of sand and loam.

5th, The light sandy soil about Bruges.

6th, the rich loam of the districts of Ghent, Courtray, and Maritime Flanders.

7th, The artificial soil of the Pays de Waes.

The Campine of Brabant.

It is well known that the Campine of Brabant, which is the northern part of that province, consisted originally of sand covered with heath, interspersed with lakes and extensive marshes, and here and there with woods of fir. Tradition supposes it to have been once a part of the sea. To this day where cultivation has not extended, the soil of itself produces nothing but heath and fir. The sand is of the most barren and harsh kind, nor can it be rendered fertile, but by continued manuring. As the property of this ground may be acquired for a trifle, many have been the attempts of private persons to bring tracts of it into cultivation; every means have been tried for that purpose, and government has given every poſsible encouragement to it. But I have not heard of any one, however considerable might be his fortune, that has succeeded in it, and many have been ruined by the project. What is cultivated in the Campine, is owing to the religious houses established in it, especially to the two great abbeys of Tongerloo and Everbode. Their uninterrupted duration for five or six hundred years past, and their indefatigable industry, have conquered these barren harsh sands, and rendered many parts of them highly productive. The method they follow is simple and uniform; they never undertake to cultivate more of this barren soil at a time than they have sufficient manure for; seldom more than five or six bunders in a year; and when it is brought by labour and manuring into a state capable of producing sufficient for a family to live on, it is let out to farmers on easy terms, after having built them comfortable habitations. By these means, many extensive tracts of the Campine are well cultivated, and covered with villages, well built houses, and churches. The abbey of Tongerloo alone furnishes about seventy of its members as curates to these parishes, all of whom owe their existence to that original stock. I may add here, and that from the undoubted testimony of the historians of the Low Countries, that the cultivation of the greatest part of these rich provinces, took its rise from the selfsame means, eight hundred or a thousand years back, when they were in a manner one continued forest.

A Campine farm of twenty bunders is stocked with two or three horses, seven or eight cows, some oxen, and is cultivated with coleseed, clover, rye, oats, and little or no wheat. It is hardly necefsary to add, that potatoes, turnips, and carrots are cultivated not only in the Campine, but throughout all the Low Countries. But the culture of spergule *(alsine spergula major)* is more peculiar to the north of Brabant, though not confined to that tract alone. It serves the cows for autumn food, and the butter of this season is called spergule butter, of which the Campine furnishes a great quantity, especially to Brussels, where it is employed for the use of the kitchen, as being both cheaper and more profitable than any other for that purpose. This plant is sown where corn has been reaped, after the ground has been lightly ploughed. Cows are tethered on it in October, and a space allowed to each one proportionable to the quantity of food which is proper for her. This pasture lasts till the frosts come on.

As spergule gives but little straw, and consequently little manure, the farmers supply the want thereof in the following manner: the peat or sods which are cut from the heath are placed in the stables and cow-stalls as litter for the cattle. The ground under them is dug to a certain depth, so as to admit a considerable quantity of these peat sods, and fresh ones are added as the feet of the cattle tread them down into leſs compaſs. These compose so many beds of manure, thoroughly impregnated with the urine and dung of the cattle. This litter is renewed at proper times, and that which is removed from the stables and cow-stalls is laid up in heaps, till it be carried into the fields where it is to be spread. This mixture produces a compost of excellent quality for fertilizing ground where corn is to be sown. By these means a far greater quantity of manure is produced from the peat, than could be had by burning it, as is done in some parts. In the Campine of Brabant, the main object which the farmers have in view, is to obtain a great quantity of manure, without which all attempts to cultivate that barren soil are in vain.

Besides butter, the Campine furnishes the rest of Brabant, and Bruſsels particularly, with great quantities of fat fowl: the markets are constantly supplied with them, and they are preferred to any other of the same kind. They are not leſs sought for and esteemed in South Holland.

Many attempts have been made to plant woods in the Campine; but, fir excepted, to no purpose, as they never grow up; and fir itself degenerates after it is thirty or forty years old; till then it thrives well.

The Parts of Brabant contiguous to the Campine.

There is no great farms in these parts, and hardly any such thing as tenants; each farmer is a proprietor; and as he cultivates his own ground, it is clear that he will do all he can to render it fertile without impoverishing it: far different in this respect from the tenant, who only seeks his own temporary interest, by forcing the soil, during his lease, if he has no aſsurance of renewing it, indifferent how much he may impoverish the land for the future.

There are many meadows in these districts, which give regularly two crops of hay, one at Midsummer, the other towards the end of August. It is not observed that frequent mowing impoverishes those meadows whose soil is deep and fat. If others of inferor soil appear spent, the custom is to sow them for three succeeding years with oats, and the last thereof mixing clover with the oats: by this means they become excellent meadows anew.

In proportion as the ground rises from the meadows, it diminishes in goodneſs, becoming at last a rough brown sand, mixed with pebbles; and under this is a stratum of compact clay, through which water filtrates with difficulty. Such ground as this gives small crops of rye, but it is excellent for black or Turkey wheat (*bled Sarrazin*).

The productions of this part of the country are wheat, rye, barley, oats, and Turkey wheat; and as food for cattle, spergule, clover, turnips and potatoes. They cultivate also rape, coleseed, and flax, chiefly for their oils; and also tobacco. I shall add a few observations on some of these.

The good corn land of this canton never lies fallow; the only rest that is given it, is to let it lie a year in the clover that was sown on it with the corn the preceding year; and then it returns again to corn, which is produced in its former abundance. It has been observed likewise, that the best crops are produced when the corn is sown thin.

Turkey wheat, made into paste, and fried with fat bacon, is the ordinary food of the peasants of these parts, and also of the Campine. It serves them likewise for fatting their fowl; of which, as was said above of the

Campine, they feed great quantities for the markets of the rest of Brabant and of Holland.

Great quantities of spergule are likewise cultivated in this district. It is sown immediately after the corn is reaped. This plant is excellent in the latter season for cows; it is wholesome, and increases the quantity and the goodneſs of their milk, and the butter made from it is fatter, and keeps better, than that made from graſs in May and June. Spergule serves likewise for manure, in light soils, on account of its succulent and fat nature; being ploughed down while it is still green, it serves as a partial amendment for sowing wheat on the ground.

Clover is sown along with rye, barley, oats, wheat, and even with flax. Clover seed is a great branch of commerce in this country. When they do not choose to let the clover grow up for seed, it is cut at least three times in a year. After the last cut, the plant is ploughed under, and makes a good manure, and with a little dung added to it, wheat or rye are profitably sown on the ground.

Turnips and carrots are sown indifferently with any sort of corn; insomuch that in autumn, after the corn is reaped, the fields appear covered with them; and it is observed, that those which grow in this manner, are better than those planted in gardens, and are an excellent and healthy food for both men and cattle.

Potatoes are here likewise of great use for both. Their culture serves to amend ground newly broken up, by dividing and lightening its too compact parts, and rendering it thereby proper for sowing rye on the following year.

Coleseed *(colza)* and rape require a strong soil, and rather dry. Flax exhausts the ground, and is detrimental to the culture of corn on it. Tobacco produces a still worse effect of the same kind.

It has been found of great use in this part of the country, to divide the land into small fields, inclosed with ditches and quickset hedges, which shelter the vegetation from the dry winds and frosts of the spring; nor are they leſs useful in long droughts, for the same reason. The ditches are receptacles for the water which runs off in rainy seasons, and contribute also to the growth of the hedges; which are cut for faggots every five or six years. Oak, beech, birch, poplar, hazel, &c. are planted for these hedges, the growth of which is kept down by frequent cutting.

The woods of this canton are composed of oak, limes, beech, elms, and poplars of several kinds, as is the case in the greatest part of Brabant. Ash and holly are seldom seen.

Wallon Brabant, and Northern parts of Hainault.

The soil I shall speak of under this head, is in general a cold compact clay, almost impenetrable to rain, and in droughts hard and full of cracks. In ploughing, the furrows are made from eight to twelve feet in distance. Lime and marl are found to be the best manures for this ground, which is manured one year in three. Long experience has shown, that the earth, after ploughing, must not be too much broken; for if it be, the rain forms it into an even compact maſs, which afterwards dries and hardens, so as to become like one of the barn floors of the country; whereas, when the earth is left in clods, these crumble away insensibly during winter and spring, and thereby cover gradually the roots and young stalks of the corn.

Culture of Wheat.—The ground whereon wheat is to be sown, is completely dunged, and ploughed five times; the first time in November, the second in March or April, the third at Midsummer, at which time the dung is spread on it, the fourth in August, the fifth and last in September. Four raziers, weighing 100lbs. each, are usually sown on a bunder, which gives in its turn fifty raziers, when the crop is good. When lime is used for manure, four waggon loads are usually laid on a bunder.

Rye.—This is sown on land that has been dunged and sown with wheat the foregoing year. Two ploughings suffice. The sowing is begun about the 20th of September, if the weather permits: and in the spring, clover is sown on it. The crop is usually ripe in July.

Meteil.—Wheat and rye sown together are called Meteil. This mixture is sown, like rye, on a ground that has borne wheat the preceding year, and which has been ploughed in the same manner. The sowing thrashed on a kind of sail-cloth spread on the ground for that purpose, and the seed carried in sacks to the farm. When the crop is good, a bunder produces about forty raziers of 80lbs. weight each. It is to be observed, that the ground whereon coleseed is to be planted, must be dunged, and twice ploughed, the same year it is put in use.

Flax.—The land for sowing flax, must be carefully cleaned from bad weeds, and well dunged. Some farmers, for the sake of getting better crops of flax, sow it on clover ground, which they dung towards the end of September, and plough afterwards. One hundred and eighty pounds of seed are sown on a bunder as soon as spring comes on. When the flax is about four inches high it is carefully weeded, without which precaution the weeds would stifle the plants; and this is repeated as often as the weeds get head anew. When the crop is good, a bunder yields about 400lbs. weight of flax. The flax of this part of the country, is much inferior in quality to that produced about Courtray and Menin.

In these parts of the Low Countries, the farms are usually much greater than in

Flanders, and in the middle region of Brabant, where the land is richer. In Hainault, all farms of above seventy bunders have been divided; but this has not extended to Wallon Brabant, where there are still many great farms.

A farm of seventy bunders* is usually distributed as follows: ten bunders of meadow, ten of wheat, twelve of rye, three of winter-barley, one of spring-barley, eight of oats, four of horse-beans, peas, and vetches, and eight of clover; which together make fifty-six bunders in cultivation, the other fourteen lying fallow, in all seventy bunders. For cultivating such a farm, eight horses are neceſsary; and it is stocked with sixteen cows, twelve oxen, and a flock of two hundred sheep; besides hogs and fowls in proportion.

The Middle Region of Brabant.

The land is here a mixture of sand and loam, which make an excellent light soil, but not so rich as that of Flanders, though preferable perhaps for corn. The usual productions of this part of the country are wheat, rye, oats, barley, beans, peas, vetches, clover, turnips, carrots, and potatoes. No ground here lies fallow; the farms are seldom extensive: forty bunders may be taken for an average. The distribution of a farm of this size is usually into about six bunders of meadow, and thirty-four of arable land.

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* About 210 English acres.

These last are manured almost yearly, with from twelve to sixteen waggon loads of manure to each bunder, those in clover excepted. On these it is usual to spread, in March, turf-ashes brought in boats from Holland. From eighty to one hundred tubs of about sixty pounds weight each are employed for a bunder, one-third of which is kept to be spread after the first cut. Many of the Flemish farmers make great use of these ashes, which being highly impregnated with salts, enrich the land so as to render it capable of producing excellent crops of wheat, without any other manure, except turning under the clover it was sown with the preceding year.

In most farm yards, a deep ditch is dug near the cow-house, into which the urine of the cattle runs, and a sufficient quantity is gathered, for spreading over two or three bunders, which proves an excellent manure.

The arable part of such a farm as I am speak-of, is distributed as follows: five bunders of wheat, five of rye, two of meteil, two of barley, four of oats, two of beans, peas, and vetches, five of clover, four of turnips, carrots, and potatoes, and five of coleseed; in all thirty-four bunders, the other six being meadow.

The following rotation is used in the culture of these parts: the ground being well manured, the first year coleseed is planted; the second year it is sown with wheat; and the third with rye, without dunging. From two to three raziers of wheat, of 80 lbs. each, are usually sown on a bunder; and when the crop is good, it yields from thirty to forty raziers of the same weight.

Some farmers spread turf-ashes on the ground where they have sown turnips and carrots, as well as on that sown with clover, &c. and then paſs the harrow over it.

In a favourable year, a journal (a quarter of a bunder) of land well manured, will produce from fifty to sixty sacks of potatoes.

Those that feed sheep in the districts where no land lies fallow, feed them, as well as their other cattle, with corn, beans, peas, vetches, turnips, and other roots.

Agriculture of Flanders; and first in the environs of Bruges.

The quality of the soil varies greatly in different parts of the district of Bruges, although the main constituent of it be every where a light sand. In many parts, continual manuring and cultivation, have rendered it extremely rich; in some spots, for want of these, it is leſs so; but a more extensive population would soon bring them into the same state as the rest.

There are many large farms in this part of the country, belonging in general to the rich abbeys; those of lay proprietors are for the most part leſs; and those of which the farmers themselves are proprietors, are still smaller. The culture in these cantons is regulated as follows:

A ghemet, or measure, of land, is manured the first year with dung, or, near Bruges, with a boat load of street-dirt from that city; it is then sown with flax; the second year wheat is sown on it; the third year rye; the fourth year it is again slightly manured, and sown with oats or Turkey wheat, and sometimes with clover, turnips, carrots, parsnips, or potatoes.

Clover is sown along with oats, and only lasts a year: it is afterwards ploughed, manured, and sown with wheat and flax.

Broom is sometimes sown as an amendment for bad land, and pulled up at the end of the second year, during winter. The ground is then dunged, ploughed, and cultivated with later crops, sown in the spring.

Turnips, carrots, parsnips, and potatoes, supply in these parts the want of meadows, and great care is taken to preserve them during winter for food for their cattle. Turnips, carrots, and parsnips are laid in the earth, in round heaps, of eight or ten feet in diameter at the bottom, and five or six feet high; when the first layer is placed it is covered with long straw; and so on alternately to the top. These heaps are opened in the winter or spring, according as the farmer has need of them for feeding his horses and cows; they are given likewise to early lambs, when young graſs is wanting.

Potatoes are kept in deep holes dug in sandy ground, where they are seldom hurt by ordinary frosts, and keep good till far on in the spring.

In this tract of country, there are many little woods of oak, elm, beech, oller, and here and there fir of the maritime kind. Great quantities of willows are planted, and some are let grow up into trees, out of which are made windlaſses for the boats and barges of the country: these sell dearer than oak.

Lands on the Rivers Lys and Scheldt, from Menin and Courtray to Ghent and Dendermonde, and also of Maritime Flanders.

The soil on the flat banks of the Lys and the Scheldt is reckoned among the best in Flanders: it is in general a rich, sandy, moist loam, become almost black with a long and uninterrupted cultivation. Hardly any great farms are found here; those of from sixty to eighty ghemets are counted the greatest, and they are generally leſs, as the land is richer.

In the largest of these farms, there are seldom more than three or four horses, and ten or twelve cows. The farmer employs from twenty to thirty waggon loads of dung for three ghemets of land, and only fifteen or sixteen loads, if it be street-dirt from the great towns, or turf-ashes brought by water from Holland.

These lands produce grain of every sort in great abundance, as also every kind of esculent roots, which are given to the cattle in winter, along with their hay. The meadows along the rivers, and in other parts of this rich and moist soil, are superiorly good, and the clover is the most luxuriant I ever saw. It is usual to spread, in the spring, sixty sacks of turf-ashes on three ghemets of clover sown the preceding year, which proves an excellent manure to it.

A great branch of culture in these parts, and particularly in the districts of Courtray and Menin, is that of flax, of which they produce an immense quantity, and of the finest kind. The expense of this culture is great, the labour bestowed on it in weeding, is almost uninterrupted, and the damage it does to the soil in exhausting its vegetable juices, is beyond measure; but in return, a good crop will almost buy the ground. To recover the soil after a crop of flax, clover and spergule are sown on it, and turned down for manure.

The plough used for this fine light soil, has a little wheel and an immoveable sower: one horse serves to draw it, or two at most in the strongest of this ground.

Lands uncultivated, and fields lying fallow, are here unknown. There are few woods in this part of the country; but all the fields are inclosed with hedges, and thick set with trees, insomuch that the whole face of the country, seen from any little height, seems one continued wood.

The agriculture in Maritime Flanders is much the same with that now spoken of, as the soils of each bear a great resemblance; only that near the sea is more moist, the meadows are more extensive, and little or no flax or spergule are there cultivated. If there be any material difference between these soils, it consists in the greater quantity of marine substances, which enter into the composition of the soil of Maritime Flanders, than of that in the inner part of the country, and these add to it an additional degree of fertility.

The castlery of Furns, and the environs of Dixmude, abound more in excellent meadows than any other part of the Low Countries: the number of horned cattle fed there is immense, as is also the quantity of butter produced and sold, chiefly at Dixmude market; and it is of the best quality both for richneſs and keeping.

The Pays de Waes.

The land of Waes is the district lying on the north side of the Scheldt, between Ghent and Antwerp; it is a perfect flat, and is reckoned the richest part of Flanders. The original soil was pure sand, and its present state of fertility, is owing to the great number of its industrious inhabitants, who cultivate a few acres round their dwellings, of which, for the most part, they are proprietors. The natural meadows are rich, and the great number of cows which the inhabitants keep, furnish manure in great abundance; but they are not content with this alone; great quantities of turf-ashes are brought thither from Holland, as also a great part of the street-dirt and dung from Bruſsels, Antwerp, and Ghent, besides what is had from the many rich and populous towns and villages, with which this district is covered.

The farms being so very small, few horses are kept in the land of Waes; the ground is chiefly worked with the spade and hoe, which the extreme lightneſs of the soil renders easy. If a plough be used, it is of the most simple kind, without wheels, and drawn by one horse. All these contribute together to give a richneſs and fertility to the soil of this tract, which surpaſses almost what can be imagined. No spot lies uncultivated.

The common method of culture is as follows: a bunder of land is manured, once in seven years, with from forty to fifty cart loads of dung, and town dirt. The first year it is sown with hemp; the second with flax; the third with wheat; the fourth and fifth with rye; the sixth with oats; and the seventh with clover, Turkey wheat, turnips, or carrots. Fallow ground is unknown here.

Spergule is sometimes sown about mid August, on land that has borne wheat; and in October the cows are put into it. The spergule which they cultivate for seed is sown in March, and reaped in June.

It is to be observed, that the riches of the land of Waes consist chiefly in the culture of flax and hemp; the other crops being in general for their own use, and for home consumption, which indeed is very considerable, on account of the great population of this district. The produce of their flax and hemp is so considerable, that in a good year they are reckoned to amount almost to the value of the ground.

The agriculture of the land of Waes, paſses, indisputably, for the most complete and perfect in all the Netherlands.

ESSAY IV.

On Hogs and their Management.

OF all the animals that are to be met with in Huſbandry, hogs are the most universal. Other animals are applicable to certain districts, or particular farms; but there is no farmer so great that does not find hogs of much consequence to his profit, nor any so small as to be beyond his reach. Even to the industrious labourer they are an object of considerable advantage. There is not an article in husbandry that more deserves the attention of a young farmer, than getting as soon as poſsible into a right system of managing his hogs. I shall consider them under the heads of 1st, Breed. 2d, Weaning. 3d, Food. 4th, Fattening. 5th, Hog-sties and yard. 6th, Profit. 7th, Distempers.

Breed.—It would be endleſs to particularize all the breeds of swine there are in England; those only which deserve our attention are, 1st, The Berkshire. 2d, Shropshire. 3d, Northampton. 4th, Chinese*.

BERKSHIRE.—This hog is spotted red and brown, comes to a great size, has small ears, short legs, and very broad sides. They are very highly esteemed; but come to so large a size, that no person should keep them who is not perfectly well provided with food; without this they will dwindle away, fall into diseases, and yield much leſs profit than a leſs breed.

SHROPSHIRE—Come to a very large size; they are both white and coloured, but usually the former; short legs, and slouching ears which hang upon their cheeks. They are a very good breed, and much esteemed at Barnet market. They nearly resemble the

NORTHAMPTON—Which are white, with very short legs; come to an immense size, especially the Naseby hogs. They are most distinguished by the immensity of their ears, which are much larger than the Shropshire, and sweep along on the ground before their noses, almost blinding them; this makes them a remarkably gentle breed. I had a boar, which, when old, was as gentle as when young.

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* Linnæus's species are, 1. Scrofa. 2. Porcus. 3. Tajaſsu. 4. Babyruſsa. 5. Æthiopicus. *Amænitates Academicæ*, Tom. v. 461.

CHINESE.—I am strongly inclined to believe this the most profitable[*] breed of hogs we have in England; they are very hardy, and will live on leſs food, by far, than any of the preceding; they are rarely seen lean, or in poor order. There are two sorts of them; one which can never be brought to any size, and another which rises to a large weight. They are also white and black[†]: the largest I have seen were the former. In the experiments I have made on hogs, I have found swine of this breed fatten well on food that would only keep other hogs.

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[*] They are also found superior to the common sorts in France.—Les cochons de la Chine préférables ans nôtres réuſsiſsent parfaitement. *Eſsais sur divers Sujets intereſsans*, p. 244.

[†] All the hogs in Italy are black, except at Bologna, and there red. *Burnet's Travels*, *Harris*, Vol. ii. p. 609.

SYSTEM.—In aſsigning the stock of hogs for a farm, a farmer should consider what is most likely to pay him well. He may keep sows, and sell their pigs for roasters: this will answer only in the neighbourhood of great markets. He may breed young hogs, and sell them for others to fat; or he may both breed and fat. He may not breed at all, but buy three or four months shoots at Michaelmas, keep them a twelvemonth, and then sell them lean; or keep and fat them. Thus a farmer has a great choice of management; nor is it easy to say which will pay him best. Breeding will answer if he has excellent conveniences, and the greatest command of food, a dairy, &c. But if he is ever likely to be in doubt in this respect, I should prefer buying in shoots at Michaelmas, keeping them a year, and then selling, or not, according to markets: if hogs ready to fat sell high, and at the same time fat pork does not find a market proportionable, then to sell lean; but if lean hogs are dull in the market, and fat pork a good article, then to fat them. It is a very easy matter, in any situation, for a young farmer to discover this point, and understand it well; and he should conduct himself accordingly.

And here it is neceſsary to remark, that I totally reject the common idea of keeping only one sow, or two or three pigs, under the notion that if more are kept the profit is nothing. A sow, living upon mere offal, yields, perhaps, a thousand per cent. profit; but nothing is more absurd than therefore to conclude that ten sows will not answer: they certainly will not pay in the same proportion, but no animal will make a better return for crops raised for them. I suppose my farmer to apply parts of his land as expreſsly to the maintenance of hogs, as of cows or sheep, and he need not apprehend its not answering.

Sows.—The Sows should always be kept confined in their yard, except when they are in the clover field; they should not go to the boar till they are nine months old, and if they are a year it will be the better. When great with pig they must be in a yard by themselves in winter, not to be disturbed by the boars and shoots; and for about a fortnight before they pig they should be confined to the sty, but each to have a small area to it. While pigging, it is eſsential that nobody goes near them; not even to look at them; for some will eat their pigs in that case, that would never touch them if they were not disturbed. They should be fed moderately before pigging, but afterwards they must have as much as they will eat of dairy wash; and baits of turnips, carrots, cabbages, or potatoes, for want of wash; with boiled potatoes or carrots, and a little meal, once a day for a fortnight. They must be kept well littered and clean; but, at pigging, not with too much, as they are more apt to overlay their pigs in it for the first week. When they have pigged a week or ten days, they may be let out of the sties into their yard for three or four hours in the middle of the day, to stretch their legs, which is better than total confinement.

Sows, when expected to take the boar, should not be kept too fat. I have been told by an observing farmer, that when his sows have gone to boar in a great acorn time, being in high order, they have never had many pigs; and that it was a common observation*.

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* Somewhat similar to this is an old remark, that when a cow is fat at taking the bull, she is much the leſs likely to be with calf. *Mascal's Government of Cattle*, p. 52.—Pliny

They will, with constant admiſsion to a boar, have three litters of pigs in fourteen months.

Weaning Pigs.—The proper age at which to wean pigs is two months, having castrated them in six weeks. They must be kept in sties that have a small yard for them to run in, and both kept perfectly clean and well littered with wheat straw or stubble. Their food must be good, and given as plentifully as they will eat. Boiled potatoes or carrots for a fortnight, and then raw ones, will prove a good food; with a bait every day for a month of oats, and afterwards pea or bean, or buckwheat meal, unleſs there is a dairy, and then a meſs of milk, or whey will answer instead of it. This must be the management till the clover field is ready for them, which may be the beginning of May; and if the pigs are then three months old, they will do well on that food. During the weaning, the article of plenty of clean straw, and great cleanneſs, so as the pigs may

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observes, that a fat sow has few pigs. *Hist. Nat.* lib. 8. cap. 51. Penuriam lactis præpingues sentiunt et primo fœtu minus sunt numerosæ.

always have fine, smooth, sleek, coats, is of such consequence, that the greatest plenty of food will not make amends for the want of it.

CASTRATION.—The pigs should be castrated at about a month old*.

RINGING.—Pigs should be rung though they do not go in neat pastures; and even hogs do not fatten so well while they have a power of rooting in their dung†.

YOUNG SHOOTS.—The young hogs that are weaned, and arrived at the age of three or four months, must, through the year, (except when in clover,) be confined to a yard by themselves. Their food may be turnips or cabbages, potatoes or carrots; also malt grains, if they sell as they do in many places, at 3d. a bushell. Turnips alone will not do; they should with them have an allowance of corn: cabbages are much better, but carrots and potatoes will keep them without any help to their full growth. If it is summer, nothing is better than the clover field.

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* But not at four, six, and even twelve months, as the French writers prescribe. *Liger Nouveau Theatre d'Agriculture*, p. 221. *Lisle's Husb.* Vol. ii. p. 328.

† Lisle's Husb. Vol. ii. p. 327.

For older hogs, of course, the same regimen will be sufficient.

Food.—Whoever designs to enter largely into keeping hogs, must make a very ample provision of food for all the seasons of the year, and for every sort of stock: if he does this with a proper foresight, he will find that no animal upon his farm will pay him better; but, on the contrary, none will answer worse if not supported in great plenty The following are the articles of food which he must particularly attend to.

Clover.—Whoever would make the most profit of which his hogs are capable, must not think of doing it without the aſsistance of this plant The great use of it in supporting swine was very little known till of late years. I have practised it many years with the greatest succeſs. A small clover field, very well fenced, with a pond in it, should be ready to receive the hogs the beginning of May. When first drove, a man and boy should keep with them late the first two or three evenings, to see that they do not attempt breaking out to come home, and to drive them to some warm hollow under shelter in a dry ditch; or under a small moveable shed littered; they will take very readily to such, and having been used to it a few nights, you need be under no further trouble about them till after harvest, or till the acorn season, or the clover is done. All hogs that are past weaning, that is, a quarter, half, and full grown; boars, and sows that have no pigs with them; sows whose pigs are in the sty, and themselves let out to bait; for all such, it is as fine food as can be provided: and there is no other way of keeping them nearly so cheap. An acre will feed from twelve to twenty middling-sized hogs through the summer.

Lucern.—The best culture of this graſs does not admit in common of its being fed; if used for swine, therefore, it must be mown for soiling. This I have known practised with very good ſucceſs. For one month's food, however, in the spring, before clover is ready to feed, lucern would be very profitable.

TARES.—The same observation is applicable to winter and spring plants; they must both be given in small racks, or else scattered over a small graſs field adjoining to the hog-yards[*].

POTATOES.—Of all articles of food which it is neceſsary to a hog-master to provide very amply, none is so indispensably neceſsary as this root. He ought, every year, to have several acres of the Howard or clustered sort, as that yields by far the greatest crop. They are of use in every step of the hog's progreſs: boiled, but better steamed, they will wean young pigs, and fat the largest hogs; and raw they are an excellent support to all other stock; such as sows, shoots, and full grown hogs. When a farmer has found how many bushels an acre of his land will yield, he may then proportion them upon this hint, that three hundred bushels will winter-feed, during six months, fifteen shoots, having some other aſsistance, to begin when three or four months old; and the advantage by feeding them will, according to circumstances, yield from 4d. to 6d. per bushel, but, on an average, 5d. supposing the times respecting hogs to be good.

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[*] Lisle's Husb. Vol ii. p. 331.

And in fattening them, the potatoes will pay also from 4d. to 6d.

Carrots—Though inferior to the preceding root for hogs, are of great use; they do excellently well for all sorts of lean stock; and also for weaning pigs, with the afsistance of a little dairy wash. Several other persons have fattened hogs on them boiled, but as they have often failed, and potatoes are certainly superior, I say nothing of that application. Upon very poor sandy soils, they should be substituted instead of potatoes, much more than on better soils; for the cluster-potatoe will yield very large crops on such. But carrots come to a considerable produce on the very poorest, and without dung; hence they are amazingly valuable in such countries to those who would go any lengths in keeping hogs.

Parsnips—are, I believe, to be preferred greatly to carrots They fatten all their pork in the island of Jersey with them. They are a much more saccharine root; and it is known, that nothing fattens a hog faster, or makes finer pork, than the sugar-cane*.

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* Le Blanc's Travels, p. 76.

CABBAGES.—From September, to the end of December, there is no plant will keep the common stock so cheaply as this; while they are green and fresh, and before much of them grows putrid, or turns yellow, they yield an immensity of food, which will support the sows and shoots to their growth, but will not do to wean upon, without considerable assistance.

TURNIPS.—The same is to be observed of turnips, but in an inferior degree, for cabbages are a much better food.

GRAINS.—Malt grains, where to be had at 4d. a bushel, or under—that is, per bushel of malt brewed, and not the grains measured, are a very good food for common stock, but they must be baited with some of the preceding articles, for they do very indifferently alone. Grains keep best when buried in cisterns, and covered with green sod roofed*.

BRAN AND POLLARD.—The use of these, to save corn, is of considerable consequence, but depending entirely on price; in some situations, there is such a demand for bran, in manufactures, &c. that it will not answer to give it to cattle; in others, it is to be had cheap; and will pay when used for hogs. Circumstances, therefore, must be the farmer's guide.

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* This was the Flemish way of preserving them *Hartlib's Legacy*, 1650, p. 88.

Mr. Jebb, of Slaine-Mills, in Ireland, ascertained the price of pollard at which it would answer to feed hogs. That which weighed six stone the barrel, paid in feeding, keeping and breeding, 10d. a barrel, pork being at 20s. per cwt*. This informs us, in England, that pork, at 4 l. per cwt. would consequently pay 3s. 4d. for such a barrel, which is 10d. a bushel of twenty-one pounds.

Those who are in the neighbourhood of the sea shore, have advantages in feeding swine that should not be neglected. Mr. Arbuthnot mentions a remarkable instance of great numbers being thus fed in North Wales, on the shell-fish, &c. they find there†.

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* Tour in Ireland, Vol. i. p. 36.

† An Inquiry into the Connection between the Price of Provisions and the Size of Farms, 8vo. 1773, p. 21.

To state a system of hog-feeding that shall take in the most beneficial of these articles, and in the most profitable manner, must have its use—

First, in keeping without breeding:

Suppose, at Michaelmas, when young shoots are every where driven to market in the greatest plenty, they are bought at about 8s. or 10s. each, and being put into a yard prepared for them, are fed regularly with cabbages till about the 20th of December, when the hard frost usually sets in, which renders the cabbages cold and frozen, so that they do not nourish this stock so well. Nine or ten weeks may be given to this food; during which period, the cabbages being in full perfection, an acre will go very far, and support them at a much cheaper rate than can be imagined by those who have not experimented it. When the frost sets in, let them be put to potatoes; which I suppose packed safe into ridges adjoining the yard. The use of this root is exceedingly convenient; for there is no other trouble in it than opening a ridge, and throwing out a few bushels twice a day. If the farm is upon a poor sandy soil, on which carrots are cultivated much cheaper than potatoes, that root is to be used instead of them, in the same manner. Let them be kept in this manner till the lucern field is grown five inches high; which, in common seasons, will be by the 10th or 12th of April, and sometimes sooner. Let them, when rung, graze in it all day, and if they do not keep to their looks, give them a bait of potatoes or carrots at night. The 10th or 12th of May, confine them entirely to the clover-field, and there keep them till the corn-fields are cleared, till acorns fall, if you have any, or till you drive them to market for sale, if lean hogs sell better than fat ones are likely to do, but if pork bears a pretty good price, put them into a sty to fat, and feed them regularly with that food which answers best. Finish the fatting with pease or barley-meal. This system is, I believe, the most advantageous, and the least troublesome and difficult of any that can be embraced; and is, I believe, to be preferred to breeding. But if breeding is gone into, the only difference lies in the sows and young pigs weaned and weaning;—all the others are to be fed exactly as I have described: these on dairy-wash, or boiled potatoes, as before mentioned. But a shoot weaned, and at such an age as to be put to any food, is, I believe, generally, to be bought as cheap, or perhaps cheaper, than bred. I speak it, however, doubtfully, for it has not yet been experimentally proved. The system described will pay as well, or better, for every article of food given, than most other applications in which they can be used.

Of fattening Hogs.—Use may be made of potatoes in fattening any swine; in some situations, and under certain circumstances, of course more than in others: they must be boiled or steamed for this use, and mixed with meal. It has been a common practice to add a sixth or seventh of barley-meal*.

When hogs are fattened on corn, I am clear in the advantage of grinding† it to meal, in which state, given dry, I have fattened many hogs very expeditiously; but they must have water always by them, as they seem to fatten in proportion to their drought. But if corn is bestowed, by much the best way of using it is, to put the meal into cisterns or tubs, and add water enough to make it of the consistence of cream, to keep it stirring every day till it has fermented and become sour*, which, in weather not very cold, will be in three weeks, and then to give it the hogs; keeping meſses prepared before-hand to succeed each other. I have tried this method many years, and with uniform succeſs; and have found, by weighing the hogs alive every week, and making comparisons with other food, that none comes up to it, being the most profitable of all others. Use half barley and half pease-meal, to choose; but if not, all of either; beans do not make so good pork. I do not perceive that the hogs are ever drunk with it, which they, of course, would be, if the vinous fermentation took place. The drunkenneſs of the distillers' hogs is said to be the reason of their fattening†.

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* They fatten them in Switzerland on both carrots and potatoes, but add a little meal in their water, which seems to me to be a hint worth attending to. *Memoires de la Societé de Berne*, 1763, Tom. iii. p. 142.

† Lisle's Husb. Vol. ii. p. 334.

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* It is remarked, that milk is kept in cisterns till sour before it is given to hogs, by Mr. Car, of Maſsingham, *Doſsie, Mem. of Agric.* Vol. iii. p. 154.

† Report of the Committee of the House of Com-

In Germany they fatten hogs upon the common gourd, and cattle also*.

There is sometimes an advantage in fattening every year a number of hogs, merely with a view to raising a good dunghill. We see some farmers go to a great expense in other ways of manuring; it may be worth the attention of others to consider if this would not be a cheaper method than any. Those who would try the experiment, should provide two articles in proper plenty; cheap food to fatten with, and litter for raising the dung. The litter may either be fern, ling, stubble, or straw: there should be great plenty of it†, as on this depends the profit.

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sions, to whom the petition of the farmers and graziers was referred, 1745, folio, p. 9.

* Memoires de la Societé de Berne, 1768, tom. ii. p. 112.

† Hogs should be kept very clean, being a clean animal, as was remarked by Child. *Hartlib's Legacy*, p. 88.—A French writer says, La paille fraiche souvent renouvellie les engraiſse autant que le manger. *Maison Rustique*, 4to, p. 100.—Which is excellent; but what are we to say to what follows: On en a vûs devenir si gras qu'ils avoient jusques a un pied et demi de lard d'épaisseur.

Rain-water falling on dung is what weakens it so much in common; and one reason why that of pigeons is so excellent, is its being always kept close in a house. Experiments have been tried on this mode of raising manure, and many are inclined to think it cheaper than any other.

The health of the animal also, as well as the value of the manure, demands much attention to cleanlineſs, which a farmer should effect by means of litter. It is a mistake to suppose the hog is so dirty an animal* as to want little care of this sort; none thrives worse under negligence.

All hogs should be fasted two or more days before killing. It is even said, that the flesh of those drove a hundred miles will take salt better than distillers' hogs, owing to fasting†.

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* It is remarkable, that the Chinese swine, in China, never wallow in the dirt; but they do it in Europe, on seeing other hogs. *Osbeck's Voyage to China*, vol. i. p. 301.

† Report of the Committee of the House of Commons, folio, 1745, p. 12.

Ringing their noses is indispensable to both lean and fat stock; the former to prevent their grubbing up pastures, and the latter to keep them from rooting among their litter. In some parts of Europe, they cut a piece of the nose-gristle off, when young*: I have once or twice seen it done in England.

Sties and Yards.—There is no farm so ill provided as not to have some hog-sties on it; but these are usually ill-contrived, unconnected, and inconvenient. Whoever enters largely into the system of hogs, will find very ample conveniences eſsential to his plan. These are,

1. A boiling, or steaming house, with a furnace, and iron boiler, that holds about twenty bushels of potatoes: this house may be very small; a cheap shed is sufficient, as it wants nothing under the cover of its roof but the boiler and steam apparatus.

2. Cisterns of brick, or well-rammed clay, adjoining the house, that any thing may be

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* Amænitates Academicæ, tom. v. p. 471.

put immediately into them, without any carriage: there should be one for milch sows and weaning pigs, another for fat hogs, and a third for lean stock. A pipe from the dairy into these cisterns, or, better against freezing, an open trough, but fixed, to conduct whey and flet milk.

5. Yards, paled in, around these cisterns; the fence at the distance of five or six feet from them, and troughs in the pales at bottom, so as to form a part of the fence; by means of them the servant who attends the hogs may lift their meat immediately out of the cisterns, and put it into the troughs, without going among the hogs, or being incommoded by them. Of these yards, there should be one for sows that are big with pig; another for pigs weaning; a third for pigs weaned; a fourth for the common stock; and a fifth for fattening swine: at the least, however, there must be four. And at the further side of the yards, opposite to the troughs, should be sheds for the hogs to lie under. If the boiling-house is taken as the centre of a circle, the cisterns will form a larger circle around it; the pathway a larger circumference still; the yard beyond that a still greater; and the concluding margin the line in which the sheds

are built. The sties in which sows are to pig should be scattered among them for convenience, so that a sow may be let in or out without being forced to go among other hogs; and yet with the convenience of letting them in or out of the yards. The best place is, therefore, in the outward circumference of sheds: which, being the largest circle of all, will admit them, and yet leave sheds enough open to the yards.

These conveniences are eſsential to the hog system, and the expense of erecting them not very considerable; an hundred pounds would do for them, upon a middling scale; and if breeding was not made a part of the busineſs, leſs money, as there would then be but two sorts of stock, lean shoots and fat hogs.

Folding.—In general it is far more advantageous to make this animal contribute to the dunghill, by confining him to well-littered yards and sties; yet it is very practicable to fold him in the manner of sheep. It is said to be a common practice in Denbigh and Flintshire*. In fattening, I should appreherd, it would be very easy richly to manure a large tract of dry graſs land by a moveable fold, and troughs on wheels, in which to give them their food; also a small shed, moveable likewise, but without any floor; and when the hogs had sufficiently trodden and dunged the space, to move on the whole apparatus; it would be the most effectual method in the world of curing moſsy and hide-bound pastures.

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* Mr. Arbuthnot's Inquiry into the Connection between the Price of Provisions and Size of Farms, 8vo. 1773, p. 21.

Profit of Swine.—The profit to be made, by entering largely into this branch of husbandry, will depend, as in most other cases, on a variety of circumstances; I mean the degree of the profit, for in every situation with which I am acquainted the advantage is not inconsiderable. It will depend on the price of lean hogs, and on that of fat pork; and also on the crops, and the cheapneſs with which cabbages, carrots, potatoes, and clover, can be raised. To give any particular calculations would not, therefore, be easy; in general, however, I shall observe, that there is no sort of stock kept upon a farm that will pay better than hogs; but this depends on very ample provision being made for them, as I know no stock that will leſs bear a deficiency of food. A sow will produce three litters in fourteen or fifteen months; but reckoning only two in a year, one in winter, the pigs sold at the market for roasters, at 5s. each; and reckoning eight to a litter, there is 2l. Another litter of eight in spring or summer, reared. And upon this plan a sow will be found to yield a surprising produce in the year. And in buying in a shoot at Michaelmas, at 7s. or 8s. and keeping it a twelvemonth, there is 20s. added to the value of it; yet if a sheep or lamb is so bought at that price, it will not, perhaps, be increased in value more than two-thirds: yet the food of both will be exactly the same; clover in summer, and cabbages or carrots, or perhaps hay, added in winter. In general, the advantages to be reaped from this stock are more applicable to all sorts and sizes of farms, to very small, as well as to extremely large ones, and to every place and situation. But it is very rare that I have seen the benefit made of them which they will admit of, resulting from what I before remarked, the unwillingneſs, so general among farmers, to raise crops on purpose for them: they can keep a few without any expense whatever, and therefore they will not raise food for many. It is very easy for a young farmer to try the experiment on two or three sows, and the pigs bred by them; or by buying in ten or a dozen shoots at Michaelmas: the clover will probably be on his farm, and a very few cabbages, potatoes, or carrots, would do the rest.

The person, of all others, who seems to have been most sensible of the advantage to be made by swine, is Mr. Roſs, of Cromartie-Scott, and whose plan of breeding, fattening, and cultivating clover and potatoes for them, much exceeds any thing I have known in England.

Distempers.—The diseases to which hogs are liable, are very few, and are troubled with those but seldom. The chief are, 1, The measles*: they are said to be perceptible in this animal only in the throat; which is usually seen, in opening their mouths, to be full of small swellings. They sometimes appear externally at the same time. I never heard of any medicine but antimony for it. 2. The fever, called also the heaving of the lights: I never saw this distemper. They give oil and brimstone for it. 3. The murrain shows itself by boils breaking out in various parts of the body: this is probably the leprosy, for which Mr. Boyle directs antimony to be given. I have seen hogs much disordered in their throats, which I imagined to be the measles; but this excepted, my own experience tells me nothing of their distempers; for they are, in general, in perfect health.

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* Ellis's Husb. Ab. and Meth. vol. ii. p. 296.

Long hair and bristles is generally an ill-sign in hogs*.

Buying and Selling.—Salesmen, jobbers, and butchers, who are in a constant practice of judging of the weight and value of a hog by the eye, want no rules to instruct them; but the farmer who has occasion to use judgment of this sort much seldomer, is by no means a match for them, and ought to have some certain rule by which to know the weight and value of a hog. From a great number of experiments it has been found, that every twenty pounds live weight of a fat hog, will yield neat dead weight from twelve to fourteen. In hogs that do not exceed twelve stone, (fourteen pounds to the stone) it will be twelve; but in larger swine it will usually be about fourteen. Hence, therefore, if the farmer weighs his fat hog alive, he knows not only the neat profitable weight dead, and consequently his value, but he also can tell, by weighing him every week, when is the right time to kill or sell him to the best advantage; for when he falls off from that daily increase which he makes in profitable fattening, then it is best to kill him.

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* Lisle's Hub. vol. ii. p. 324.

In buying or selling lean hogs, it is a much fairer and more certain way to judge by weight than by the eye. I cannot instruct a man how much a pound, live weight, he should give, for it will, of course, depend on the price at market; I may, however, remark, that I have found it to vaty from 1½d. to 2½d. per pound*. If a young farmer weighs a few lean swine, about the size of those he wants to buy, he will be a better judge how to bid at a market or fair.

Bacon.—The art of curing pork, so as to

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* Written in 1770.

make good bacon[*], is not generally known. In the east of England they are acquainted only with hams pickled and smoaked, and with pickled pork: the latter is merely rubbed well with common salt, and put into the powdering tub, with heavy weights on it.

It had long been an idea, that pork could not be salted in very hot climates; but Captain Cook, with the penetration he exerted on every subject, showed that this was an error. His method deserves attention[†].

SKINS.—It seems to be rather a want of economical attention in this kingdom, that no use is made of hogs' leather, except the hide of an old boar. Yet the shoes that the Chinese sell to the Europeans at Canton, are made of it, the hair being burnt off with a red hot iron[‡]. It was a wise proceeding in the Imperial Economical Society at Petersburg, to offer a premium, which they did in 1780, for the best method of applying the skins of hogs to use by tanning*.

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[*] For the Westphalia way, see *Bradley's General Treatise of Husbandry and Gardening*, vol I. p. 115.

[†] Cook's Last Voyage, 4to, vol ii. p. 135. Vol. iii. p. 11.

[‡] Osbeck's Voyage to China, vol. i. p. 234.

ESSAY V.

On Insects.

THE structure, and the use of the parts, of insects, are leſs understood than that of quadrupeds and birds, not only by reason of their minuteneſs, or the minuteneſs of their parts, (for that minuteneſs we can, in some measure, follow with glaſses) but also, by reason of the remoteneſs of their manners and modes of life from those of larger animals. For instance: Insects, under all their varieties of form, are endowed with antennæ, which is the name given to those long feelers that rise from each side of the head; but to what common use or want of the insect kind, a provision so universal is subservient, has not yet been ascertained; and it has not been ascertained, because it admits not of a clear, or very probable, comparison, with any organs which we poſseſs ourselves, or with the organs of animals which resemble ourselves in their functions and faculties, or with which we are better acquainted than we are with insects. We want a ground of analogy. This difficulty stands in our way as to some particulars in the insect constitution which we might wish to be acquainted with. Neverthelefs, there are many contrivances in the bodies of insects, neither dubious in their use, nor obscure in their structure, and most properly mechanical. These form parts of our argument.

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* Journal Encyclopedique, 1781, Tom. ii. part 3. p. 519.

I. The elytra, or scaly wings of the genus of scarabæus, or beetle, furnish an example of this kind. The true wing of the animal is a light transparent membrane, finer than the finest gauze, and not unlike it. It is also when expanded, in proportion to the size of the animal, very large. In order to protect this delicate structure, and, perhaps, also to preserve it in a due state of suppleneſs and humidity, a strong, hard, case is given to it, in the shape of the horny wing which we call the elytron. When the animal is at rest, the gauze wings lie folded up under this impenetrable shield. When the beetle prepares for flying, he raises the integument, and spreads out his thin membrane to the air. And it cannot be observed without admiration, what a tiſsue of cordage, i. e. of muscular tendons, must run, in various and complicated, but determinate directions, along this fine surface, in order to enable the animal, either to gather it up into a certain precise form, whenever it desires to place its wings under the shelter which nature hath given to them; or to expand again their folds, when wanted for action.

In some insects, the elytra cover the whole body; in others, half; in others, only a small part of it; but in all they completely hide and cover the true wings. Also,

Many or most of the beetle species lodge in holes in the earth, environed by hard, rough, substances, and have frequently to squeeze their way through narrow paſsages; in which situation, wings so tender, and so large, could scarcely have escaped injury, without both a firm covering to defend them, and the capacity of collecting themselves up under its protection.

II. Another contrivance, equally mechanical, and equally clear, is the awl or borer fixed at the tails of various species of flies; and with which they pierce, in some cases, plants; in others, wood; in others, the skin and flesh of animals; in others, the coat of the chrysalis of insects of a different species from their own; and in others, even lime, mortar, and stone. I need not add, that having pierced the substance, they deposit their eggs in the hole. The descriptions, which naturalists give of this organ, are such as the following. It is a sharp-pointed instrument, which, in its inactive state, lies concealed in the extremity of the abdomen, and which the animal draws out at pleasure, for the purpose of making a puncture in the leaves, stem, or bark of the particular plant, which is suited to the nourishment of its young. In a sheath, which divides and opens whenever the organ is used, there is inclosed, a compact, solid, dentated stem, along which runs a gutter, or groove, by which groove, after the penetration is effected, the egg, aſsisted, in some cases, by a peristaltic motion, paſses to its destined lodgment. In the œstrum, or gadfly, the wimble draws out like the pieces of a spy-glaſs; the last piece is armed with three hooks, and is able to bore through the hide of an ox. Can any thing more be neceſsary to display the mechanism, than to relate the fact?

III. The stings of insects, though for a different purpose, are, in their structure, not unlike the piercer. The sharpness to which the point in all of them is wrought; the temper and firmneſs of the substance of which it is composed; the strength of the muscles by which it is darted out, compared with the smallneſs and weakneſs of the insect, and with the soft or friable texture of the rest of the body, are properties of the sting to be noticed, and not a little to be admired. The sting of a bee will pierce through a goatskin glove. It penetrates the human skin more readily than the finest point of a needle. The action of the sting affords an example of the union of chymistry and mechaniſm, such as, if it be not a proof of contrivance, nothing is. First, as to the chymistry; how highly concentrated must be the venom, which, in so small a quantity, can produce such powerful effects? And in the bee we may observe, that this venom is made from honey, the only food of the insect, but the last material from which I should have expected, that an exalted poison could, by any proceſs or digestion whatsoever, have been prepared. In the next place, with respect to the mechanism, the sting is not a simple, but a compound instrument. The visible sting, though drawn to a point exquisitely sharp, is in strictneſs only a sheath; for, near to the extremity, may be perceived by the microscope two minute orifices, from which orifices, in the act of stinging, and, as it should seem, after the point of the main sting has buried itself in the flesh, are launched out two subtile rays, which may be called the true or proper stings, as being those, through which the poison is infused into the puncture already made by the exterior sting. I have said that chymistry and mechanism are here united: by which observation I meant, that all this machinery would have been useleſs, *telum imbelle*, if a supply of poison, intense in quality, in proportion to the smallneſs of the drop, had not been furnished to it by the chymical elaboration which was carried on in the insect's body: and that, on the other hand, the poison, the result of this proceſs, could not have attained its effect, or reached its enemy; if, when it was collected at the extremity of the abdomen, it had not found there a machinery, fitted to conduct it to the external situations in which it was to operate, viz. an awl to bore a hole, and a syringe to inject the fluid. Yet these attributes, though combined in their action, are independent in their origin. The venom does not breed the sting; nor does the sting concoct the venom.

IV. The proboscis, with which many insects are endowed, comes next in order to be considered. It is a tube attached to the head of the animal. In the bee, it is composed of two pieces, connected by a joint: for, if it were constantly extended, it would be too much exposed to accidental injuries; therefore, in its indolent state, it is doubled up by means of the joint, and in that position lies secure under a scaly penthouse. In many species of the butterfly, the proboscis, when not in use, is coiled up like a watch-spring. In the same bee, the proboscis serves the office of the mouth, the insect having no other: and how much better adapted it is, than a mouth would be, for the collecting of the proper nourishment of the animal, is sufficiently evident. The food of the bee is the nectar of flowers; a drop of syrup, lodged deep in the bottom of the corollæ, in the receſses of the petals, or down the neck of a monopetalous glove. Into these cells the bee thrusts its long narrow pump, through the cavity of which it sucks up this precious fluid, inacceſsible to every other approach. It is observable also, that the plant is not the worse for what the bee does to it. The harmleſs plunderer rifles the sweets, but leaves the flower uninjured. The ringlets of which the proboscis of the bee is composed, the muscles by which it is extended and contracted, form so many microscopical wonders. The agility also, with which it is moved, can hardly fail to excite admiration. But it is enough for our purpose to observe in general, the suitableneſs of the structure to the use, of the means to the end, and especially the wisdom, by which nature has departed from its most general analogy, (for animals being furnished with mouths is such) when the purpose could be better answered by the deviation.

In some insects the proboscis, or tongue, or trunk, is shut up in a sharp-pointed sheath, which sheath, being of a much firmer texture than the proboscis itself, as well as sharpened at the point, pierces the substance which contains the food, and then opens within the wound, to allow the inclosed tube, through which the juice is extracted, to perform its office. Can any mechanism be plainer than this is; or surpaſs this?

V. The metamorphosis of insects from grubs into moths and flies, is an astonishing proceſs. A hairy caterpillar is transformed into a butterfly. Observe the change. We have four beautiful wings, where there were none before; a tubular proboscis, in the place of a mouth with jaws and teeth; six long legs, instead of fourteen feet. In another case, we see a white, smooth, soft worm, turned into a black, hard, crustaceous beetle, with gauze wings. These, as I said, are astonishing proceſses, and must require, as it should seem, a proportionably artificial apparatus. The hypothesis which appears to me most probable is, that, in the grub, there exist at the same time three animals, one within another, all nourished by the same digestion, and by a communicating circulation; but in different stages of maturity. The latest discoveries, made by naturalists, seem to favour this supposition. The insect already equipped with wings, is descried under the membranes both of the worm and nymph. In some species, the proboscis, the antennæ, the limbs and wings of the fly, have been observed to be folded up within the body of the caterpillar; and with such nicety, as to occupy a small space only under the two first wings. This being so, the outermost animal, which beside its own proper character serves as an integument to the other two, being the furthest advanced, dies, as we suppose, and drops off first. The second, the pupa, or chrysalis, then offers itself to observation. This also, in its turn, dies; its dead and brittle husk falls to pieces, and makes way for the appearance of the fly, or moth. Now, if this be the case, or indeed whatever explication be adopted, we have a prospective contrivance of the most curious kind: we have organizations three deep; yet a vascular system, which supplies nutrition, growth, and life, to all of them together.

VI. Almost all insects are oviparous. Nature keeps her butterflies, moths, and caterpillars, locked up during the winter in their egg state, and we have to admire the various devices, to which, if we may so speak, the same nature hath resorted for the security of the egg. Many insects inclose their eggs in a silken web; others cover them with a coat of hair, torn from their own bodies; some glue them together; and others, like the moth of the silkworm, glue them to the leaves upon which they are deposited, that they may not be shaken off by the wind, or washed away by rain: some again make incisions into leaves, and hide an egg in each incision; whilst some envelope their eggs with a soft substance, which forms the first aliment of the young animal; and some again make a hole in the earth, and, having stored it with a quantity of proper food, deposit their egg in it. In all which we are to observe, that the expedient depends, not so much upon the addreſs of the animal, as upon the physical resources of his constitution.

The art also with which the young insect is coiled up in the egg, presents, where it can be examined, a subject of great curiosity. The insect, furnished with all the members which it ought to have, is rolled up into a form which seems to contract it into the least poſsible space; by which contraction, notwithstanding the smallneſs of the egg, it has room enough in its apartment, and to spare. This folding of the limbs appears to me to indicate a special direction; for, if it were merely the effect of compreſsion, the collocation of the parts would be more various than it is. In the same species, I believe, it is always the same.

These observations belong to the whole insect tribe, or to a great part of them. Other observations are limited to fewer species; but not, perhaps, leſs important or satisfactory.

I. The organization in the abdomen of the silkworm, or spider, whereby these insects form their thread, is as incontestably mechanical, as a wire-drawer's mill. In the body of the silkworm are two bags, remarkable for their form, position, and use. They wind round the intestine; when drawn out they are ten inches in length, though the animal itself be only two. Within these bags, is collected a glue; and communicating with the bags, are two paps, or outlets, perforated, like a grater, by a number of small holes. The glue or gum, being paſsed through these minute apertures, forms hairs of almost imperceptible fineneſs; and these hairs, when joined, compose the silk which we wind off from the cone, in which the silkworm has wrapped itself up: in the spider, the web is formed from this thread. In both cases, the extremity of the thread, by means of its adhesive quality, is first attached by the animal to some external hold; and the end being now fastened to a point, the insect, by turning round its body, or by receding from that point, draws out the thread through the holes above described, by an operation, as hath been observed, exactly similar to the drawing of wire. The thread, like the wire, is formed by the hole through which it paſses. In one respect there is a difference. The wire is the metal unaltered, except in figure. In the animal proceſs, the nature of the substance is somewhat changed, as well as the form: for, as it exists within the insect, it is a soft, clammy, gum or glue. The thread acquires, it is probable, its firmneſs and tenacity from the action of the air upon its surface, in the moment of exposure; and a thread so fine is almost all surface. This property, however, of the paste, is part of the contrivance.

The mechanism itself consists of the bags, or reservoirs, into which the glue is collected, and of the external holes communicating with these bags: and the action of the machine is seen, in the forming of a thread, as wire is formed, by forcing the material already prepared, through holes of proper dimensions. The secretion is an act too subtle for our discernment, except as we perceive it by the produce. But one thing answers to another: the secretory glands to the quality and consistence required in the secreted substance; the bag to its reception. The outlets and orifices are constructed, not merely for relieving the reservoirs of their burden, but for manufacturing the contents into a form and texture, of great external use, or rather, indeed, of future neceſsity, to the life and functions of the insect.

II. Bees, under one character or other, have furnished every naturalist with a set of observations. I shall, in this place, confine myself to one; and that is the relation which obtains between the wax and the honey. No person who has inspected a bee-hive, can forbear remarking, how commodiously the honey is bestowed in the comb: and amongst other advantages how effectually the fermentation of the honey is prevented by distributing it into small cells. The fact is, that when the honey is separated from the comb, and put into jars, it runs into fermentation, with a much leſs degree of heat than what takes place in a hive. This may be reckoned a nicety: but independently of any nicety in the matter, I would ask, what could the bee do with the honey, if it had not the wax? how, at least, could it store it up for winter? The wax, therefore, answers a purpose with respect to the honey; and the honey constitutes that purpose with respect to the wax. This is the relation between them. But the two substances, though, together, of the greatest use, and, without each other, of little, come from a different origin. The bee finds the honey, but makes the wax. The honey is lodged in the nectaria of flowers, and probably undergoes little alteration; is merely collected: whereas the wax is a ductile, tenacious paste, made out of a dry powder, not simply by kneading it with a liquid, but by a digestive proceſs in the body of the bee. What account can be rendered of facts so circumstanced, but that the animal, being intended to feed upon honey, was, by a peculiar external configuration, enabled to procure it? that, moreover, wanting the honey when it could not be procured at all, it was further endued with the no leſs neceſsary faculty of constructing repositories for its preservation? which faculty, it is evident, must depend, primarily, upon the capacity of providing suitable materials. Two distinct functions go to make up the ability. First, the power in the bee, with respect to wax, of loading the farina of flowers upon its thighs: microscopic observers speak of the spoon-shaped appendages, with which the thighs of bees are beset for this very purpose: but inasmuch as the art and will of the bee may be supposed to be concerned in this operation, there is, secondly, that which doth not rest in art or will, a digestive faculty which converts the loose powder into a stiff substance. This is a just account of the honey and the honeycomb: and this account, through every part, carries a creative intelligence along with it.

The sting also of the bee has this relation to the honey, that it is neceſsary for the protection of a treasure which invites so many robbers.

III. Our busineſs is with mechanism. In

the panorpa tribe of insects, there is a forceps in the tail of the male insect, with which he catches and holds the female. Are a pair of pinçers more mechanical, than this provision, in their structure? or is any structure more clear and certain in its design?

IV. St. Pierre tells us*, that in a fly with six feet, (I do not remember that he describes the species,) the pair next the head, and the pair next the tail, have brushes at their extremities, with which the fly dreſses, as there may be occasion, the anterior or the posterior part of its body; but that the middle pair have no such brushes, the situation of these legs not admitting of the brushes, if they were there, being converted to the same use. This is a very exact mechanical distinction.

V. If the reader, looking to our distributions of science, wish to contemplate the chymistry, as well as the mechanism of nature, the insect creation will afford him an example. I refer to the light in the tail of a glow-worm. Two points seem to be agreed upon by naturalists concerning it: first, that it is phosphoric; secondly, that its use is to attract the male insect. The only thing to be inquired after, is the singularity, if any such there be, in the natural history of this animal, which should render a provision of this kind more neceſsary for it, than for other insects. That singularity seems to be the difference, which subsists between the male and the female; which difference is greater than what we find in any other species of animal whatever. The glow-worm is a female caterpillar; the male of which is a fly; lively, comparatively small, diſsimilar to the female in appearance, probably also as distinguished from her in habits, pursuits, and manners, as he is unlike in form and external constitution. Here then is the adversity of the case. The caterpillar cannot meet her companion in the air. The winged rover disdains the ground. They might never therefore be brought together, did not this radiant torch direct the volatile mate to his sedentary female.

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* Vol. i. p. 342.

In this example we also see the resources of art anticipated. One grand operation of chymistry is the making of phosphorus; and it was thought an ingenious device, to make phosphoric matches supply the place of lighted tapers. Now this very thing is done in the body of the glow-worm. The phosphorus is not only made, but kindled; and caused to emit a steady and genial beam, for the purpose which is here stated, and which I believe to be the true one.

VI. Nor is the last the only instance that entomology affords, in which our discoveries, or rather our projects, turn out to be imitations of nature. Some years ago, a plan was suggested, of producing propulsion by reaction in this way. By the force of a steam engine, a stream of water was to be shot out of the stern of a boat; the impulse of which stream upon the water in the river, was to push the boat itself forward: it is, in truth, the principle by which sky-rockets ascend in the air. Of the use or the practicability of the plan I am not speaking; nor is it my concern to praise its ingenuity; but it is certainly a contrivance. Now, if naturalists are to be believed, it is exactly the device, which nature has made use of, for the motion of some species of aquatic insects. The larva of the dragon fly, according to Adams, swims by ejecting water from its tail; is driven forward by the re-action of water in the pool upon the current iſsuing in a direction backward from its body.

VII. Again; Europe has lately been surprised by the elevation of bodies in the air by means of a balloon. The discovery consisted in finding out a manageable ſubstance, which was, bulk for bulk, lighter than air; and the application of the discovery was, to make a body composed of this substance bear up, along with its own weight, some heavier body which was attached to it. This expedient, so new to us, proves to be no other than what the Author of Nature has employed in the goſsamer spider. We frequently see this spider's thread floating in the air, and extended from hedge to hedge, acroſs a road, or brook, of four or five yards width. The animal which forms the thread, has no wings wherewith to fly from one extremity to the other of this line; nor muscles to enable it to spring or dart to so great a distance. Yet its Creator hath laid for it a path in the atmosphere; and after this manner. Though the animal itself be heavier than air, the thread which it spins from its bowels is specifically lighter. This is its balloon. The spider left to itself would drop to the ground; but, being tied to its thread, both are supported. We have here a very peculiar provision: and to a contemplative eye it is a gratifying spectacle, to see this insect wafted on her thread, sustained by a levity not her own, and traversing regions, which, if we examined only the body of the animal, might seem to have been forbidden to its nature.

I think it is in this claſs of animals, above all others, especially when we take in the multitude of species which the microscope discovers, that we are struck with what Cicero has called "the insatiable variety of nature." There are said to be six thousand species of flies; seven hundred and sixty butterflies; each different from all the rest. (St. Pierre.) The same writer tells us from his own observation, that thirty-seven species of winged insects, with distinctions well expreſsed, visited a single strawberry plant in the course of three weeks*. Ray observed, within the compaſs of a mile or two of his own house, two hundred kinds of butterflies, nocturnal and diurnal. He likewise aſserts, but, I think, without any grounds of exact computation, that the number of species of insects, reckoning all sorts of them, may not be short of ten thousand*. And in this vast variety of animal forms, (for the observation is not confined to insects, though more applicable perhaps to them than to any other claſs,) we are sometimes led to take notice of the different methods, or rather of the studiously diversified methods, by which one and the same purpose is attained. In the article of breathing, for example, which was to be provided for in some way or other, besides the ordinary varieties of lungs, gills, and breathing-holes, (for insects in general respire, not by the mouth, but through holes in the sides,) the nymphæ of gnats have an apparatus to raise their backs to the top of the water, and so take breath. The hydrocanthari do the like by thrusting their tails out of the water†. The maggot of the eruca labra has a long tail, one part sheathed within another, (but which it can draw out at pleasure,) with a starry tuft at the end, by which tuft, when expanded upon the surface, the insect both supports itself in the water, and draws in the air which is neceſsary. In the article of natural clothing, we have the skins of animals invested with scales, hair, feathers, mucus, froth; or itself turned into a shell or crust: in the no leſs neceſsary article of offence and defence, we have teeth, talons, beaks, horns, stings, prickles, with (the most singular expedient for the same purpose) the power of giving the electric shock, and, as is credibly related of some animals, of driving away their pursuers by an intolerable fœtor, or of blackening the water through which they are pursued. The consideration of these appearances might induce us to believe, that variety itself, distinct from every other reason, was a motive in the mind of the Creator, or with the agents of his will.

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* Vol. i. p. 3.

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* Wisdom of God, p. 23. † Derham, p. 7.

To this great variety in organized life the Deity has given, or perhaps there arises out of it, a corresponding variety of animal appetites. For the final cause of this we have not far to seek. Did all animals covet the same element, retreat, or food, it is evident how much fewer could be supplied and accommodated, than what at present live conveniently together, and find a plentiful subsistence. What one nature rejects, another delights in. Food, which is nauseous to one tribe of animals, becomes, by that very property which makes it nauseous, an alluring dainty to another tribe. Carrion is a treat to dogs, ravens, vultures, fish. The exhalations of corrupted substances attract flies by crowds. Maggots revel in putrefaction.

ESSAY VI.

On the Willow.

OF this GENUS there are thirty-one species; but, in this Eſsay, I shall only enumerate such as are planted in this country for use. The species are:

1. SALIX *(alba)* foliis lanceolatis acuminatis serratis utrinque pubescentibus; serraturis infimis glandulosis. Lin. Sp. Pl. 1449. *Willow with spear-shaped, acute-pointed, sawed leaves,*

which are downy on both sides, and glands below the saws. Salix vulgaris alba arborescens. C. B. P. 453. *The White Willow.*

This is the common White Willow, which is frequently found growing on the sides of rivers and ditches in many parts of England. It grows to a large size, if the branches are not lopped off; the shoots are covered with a smooth, pale, green bark; the leaves are spear-shaped, between three and four inches long, and nearly one broad in the middle, drawing to a point at each end; they are very white on their under side, and their upper side is covered with short, white, woolly hairs, though not so closely as the under; the catkins are short and pretty thick. The wood is very white, and polishes smooth, on which account it is much sought after for milk-pails, &c.

2. SALIX *(triandria)* foliis serratis glabris, floribus triandris. Lin. Sp. Plant. 1442. *Willow with smooth sawed leaves, and flowers having three stamina.* Salix, folio auriculato splendente, flexilis. Raii. Hist. 1420. *Willow with lucid eared leaves and flexible branches. The Smooth Willow.*

This sort grows to be a large tree; the young branches are covered with a grayish bark; the leaves are smooth, and of a lucid green, ending in acute points; they are eared at their base, and sawed on their edges, and are green on both sides; the branches grow pretty erect and are flexible. This is frequently planted in Ozier grounds for the basket-maker. The catkins are long and narrow, and the scales open and acute-pointed.

3. Salix *(pentandria)* foliis serratis glabris, flosculis pentandris. Lin. Sp. Pl. 1442. *Willow with smooth sawed leaves, and flowers having five stamina.* Salix folio laureo, seu lato glabro odorato. Raii. Hist. 1420. *Willow with a bay-leaf, or broad-leaf, smooth and sweet-scented. The Sweet Willow.*

This has thick strong shoots covered with a dark-green bark; the leaves are broad, and rounded at both ends; they are very smooth, sawed on their edges, and when rubbed have a grateful smell. It is sometimes called the Bay-leafed Willow, and is a tree of quick growth. The branches are brittle, which makes them improper for many purposes.

4. Salix *(vitellina)* foliis serratis ovatis acutis glabris; serraturis cartilagineis, petiolis calloso-punctatis. Lin. Sp. Pl. 1442. *Willow with smooth, oval, acute, sawed leaves, having cartilaginous indentures, and foot-stalks with callous punctures.* Salix sativa lutea, folio crenato. C. B. P. 473. *Yellow cultivated*

Willow with a crenated leaf. The Golden Willow.

This sort has slender tough shoots, which are of a yellow colour; the leaves are oval, acute-pointed, smooth, and sawed on their edges; the saws are cartilaginous, and the foot-stalks of the leaves have callous punctures. Being very pliable, it is much planted in the Ozier grounds for the basket-maker, but it never grows to a large size.

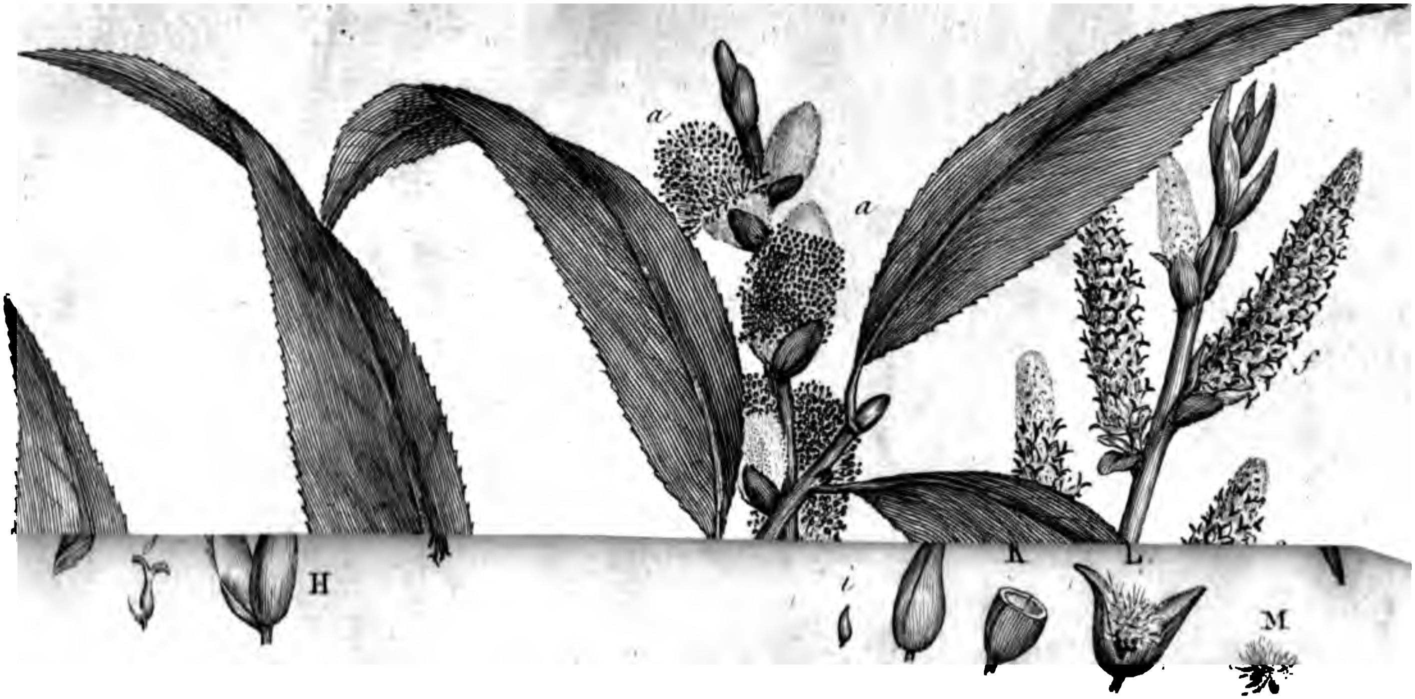
5. SALIX *(amygdalina)* foliis serratis glabris lanceolatis petiolatis, stipulis trapeziformibus. Lin. Sp. Pl. 1442. *Willow with smooth, spear-shaped, sawed leaves, having foot-stalks, and trapezium-shaped stipulæ.* Salix folio amygdalino utrinque virente aurito. C. B. P. 43. *Almond-leaved Willow with leaves which are eared, and green on both sides. The Almond-leaved Willow.*

This is a Willow of the middle size, sending forth numerous, flexible, tough branches, covered with a light green bark. The leaves are spear-shaped, smooth, serrated, acute, eared at their base, and of a light green colour on both sides. The flowers are oblong catkins, which turn to a light down in the summer. There are several sorts of this species which are of inferior value; but this is generally distinguished from the others by the name of the Old Almond-leaved

Willow. The branches are very tough and flexible, and when planted in the Ozier way, and grown one year from the stools, are very strong, and highly serviceable for the different purposes of basket-making.

6. SALIX *(fragilis)* foliis serratis glabris ovato-lanceolatis, petiolis dentato-glandulosis. Lin. Sp. Pl. 1442. *Willow with oval spear-shaped, smooth, sawed leaves, and dentated glandular foot-stalks.* Salix folio longo latoque splendente, fragilis. Raii Syn. 3. p. 448. *The Crack Willow.*

This grows to a middle size; the shoots are covered with a brownish bark, and very brittle, so are unfit for the basket-maker. The leaves are near five inches long, and one broad, are of a lucid green on both sides, and sawed on their edges; the catkins are long and slender, and the scales are pretty long, acute-pointed, and stand open. It is commonly called the Crack Willow, from the branches being very brittle. *a.* The male catkin growing on a different tree from the female. *b.* A male flower. B. Ditto with its nectarium *c*, and two stamina *d. d.* magnified. E. The scale and nectarium magnified. *f.* The female catkin. *g.* A female flower. G. Ditto magnified. H. The embryo, magnified. *i.* The capsule. I. Ditto, magnified. K. A transverse section of ditto magnified. L. As it bursts, to emit the seed, magnified. M. A seed, magnified.



The Crack Willow.

7. SALIX *(purpurea)* foliis serratis glabris lanceolatis; inferioribus oppositis. Lin. Sp. Pl. 1444. *Willow with smooth, spear-shaped, sawed leaves, the lower of which grow opposite.* Salix folio longo subluteo non auriculato, viminibus rubris. Raii Syn. 450. *The Purple Willow.*

This is a tree of middling size; the shoots are very pliable, and fit for the basket-maker, which recommends it for the Ozier grounds; they are of a reddiſh colour; the leaves are spear-shaped, smooth, and sawed on their edges: those on the lower part of the branches are placed opposite, but on the upper they are alternate, and of a yellowish green.

8. SALIX *(viminalis)* foliis subintegerrimis lanceolato-linearibus longiſsimis acutis subtus sericeis, ramis virgatis. Lin. Sp. Pl. 1448. *Willow with the longest, linear spear-shaped, acute leaves, which are almost entire, and silky on their under side, and rod-like branches.*— Salix foliis angustis et longiſsimis crispis subtus albicantibus. J. B. i. p. 212. *Willow with the longest, narrow, curled leaves, which are white on their under side. The Ozier.*

The Ozier is a tree of low growth, though the shoots grow amazingly long and strong in one year from the stools. The leaves are spear-shaped, narrow, long, acute, almost entire, of a blueish green on their upper side and hoary underneath, and grow on very short foot-stalks. This is the most propagated of all the kinds for basket-making: It admits of several sorts of different value, but all are useful to the basket-maker. The varieties usually go by the names of the Green Ozier, the Old Basket Ozier, Welch Wicker, &c.

9. SALIX *(rubra)* foliis integerrimis glabris lineari-lanceolatis acutis. Huds. Flor. Angl. 428. *Willow with entire, linear spear-shaped, smooth leaves.* Salix minimè fragilis foliis longiſsimis utrinque viridibus, non serratis. Raii Syn. 449. *The least brittle Willow, with very long leaves which are green on both sides, and not sawed. The Red Willow.*

This sort having very pliant branches, is much planted in the Ozier grounds. The leaves are very long; are spear-shaped and entire, and green on both sides. It grows to a middling size, if planted in moist land.

10. SALIX *(Babylonica)* foliis serratis glabris lineari-lanceolatis, ramis pendulis. Lin. Sp. Pl. 1443. *Willow with smooth, sawed, linear spear-shaped leaves, and hanging branches.* Salix Orientalis, flagellis deorsum pulchrè pen-

dentibus. Tourn. Cor. 41. *The Babylonian, or Weeping Willow.*

The Weeping Willow of Babylon grows to a considerable size. Its branches are long, slender, and pendulous, which makes it proper to be planted upon the banks of rivers, ponds, and over springs; the leaves are long and narrow; and when any mist or dew falls, a drop of water is seen hanging at their extremities, which, together with the hanging branches, gives this tree a most mournful look. On that account, garlands of forsaken lovers were made of the twigs of this Willow.—" The Willow, worn of forlorn paramours."—SPENCER.——" I offered him my " company to a Willow-tree, to make him a garland " as being forsaken."—SHAKSPEARE.

It is probable that under those trees the children of Israel mourned their captivity. " By the rivers of " Babylon, there we sat down, yea we wept when we " remembered Zion: We hanged our harps upon the " Willows in the midst thereof."—PSALMS. In the tragedy of Macbeth, Malcolm, under similar circumstances, expreſses his grief in the same emphatical manner.—" Let us seek out some desolate shade, and " there weep our sad bosoms empty."

11. SALIX *(helix)* foliis serratis glabris lanceolato-linearibus, superioribus oppositis obliquis. Lin. Sp. Pl. 1444. *Willow with linear, spear-shaped, smooth, sawed leaves, the upper of which are placed obliquely opposite.* Salix

humilior, foliis angustis subcæruleis ex adverso binis. Raii Syn. 2. p. 297. *The Rose Willow.*

The Rose-Willow is of much lower growth than the former. The body of the tree is covered with a rough, yellow bark. The branches are upright, tough, and of a reddish colour. The leaves are spear-shaped, narrow, smooth, of a blueish green colour, and, towards the upper part of the branches, are nearly opposite to each other. The flowers come out from the sides of the branches, and numbers of them are joined together in a rose-like manner, forming a singular and beautiful appearance. This, however, is not a flower, but an accidental excreſsence, occasioned by a wound made in the bark of the tender branches by a certain fly, for the reception of its egg, which soon produces a worm. This insect is minutely described by Swammerdam in his "Book of Nature." Our old English botanists being unacquainted with this part of natural history, supposed the tree a distinct species, and called it Salix Rosea.

12. SALIX. *(caprea)* foliis ovatis rugosis, subtus tomentosis, undatis supernè denticulatis. Lin. Sp. Pl. 1448. *Willow with oval rough leaves which are waved, woolly on their under side, and indented towards the top.* Salix latifolia rotunda. C. B. P. 474. *The Sallow.*

The Sallow is well known all over England, and delights in a dry, rather than a moist soil. It is a tree rather below the middle growth. The branches are brittle, smooth, of a dark green colour, and their chief use is for hurdle-wood and the fire; though the trunk, or old wood, is admirable for several uses in the turnery way. The leaves are oval, rough, waved, indented on the top, and woolly underneath. The catkins are very large and white; they appear early in the spring, and are much resorted to by the bees, on their first coming out of their hives at that early season.—The bark of this species of Willow, has been found of equal efficacy with the Peruvian Bark in agueish complaints. It comes cheap; and as the tree is a native of this country, it may prove a valuable acquisition to the Materia Medica. When used in decoction, the following formula is recommended. ℞. Corticis Salicis latifoliæ siccati ℥ iſs. In pulverem craſsum redige, et macera in aquæ fontanæ libris duabus per horas sex; deinde coque leni igne per quartam vel tertiam partem horæ et cola pro usu. Capiat æger cochlearia duo vel tria larga decocti ter vel quater de die; sed in febre intermitente, dare oportet unciam unam aut duas secundâ vel tertiâ quoque horâ absente paroxysmo.

13. SALIX *(hermaphroditica)* foliis serratis glabris, floribus hermaphroditis diandris. Lin. Sp. Pl. 1442. Salix latifolia folio splendente. Raii Syn. 450. *The Shining Willow.*

This is a large growing tree, sending forth several slender branches, which hang down and are covered with a pale brown bark. The leaves are smooth, glandalous, serrated, and of a yellowish green colour. The flowers are numerous hairy catkins, and the male flowers have two stamina only. They appear early in the spring; and the females are succeeded by downy seeds, like the common Willow.

14. Salix *(phylicifolia)* foliis serratis glabris lanceolatis: crenis undatis. Lin. Sp. Pl. 1442. *The Phylica-Leaved Willow.*

This is a tree of lower growth than the former. The branches are numerous, flexible, tough, and serviceable for several articles in the basket way. The leaves are spear-shaped, smooth, serrated, and waved on their edges. The flowers are long catkins, which come out early in the spring from the sides of the branches, and they soon afford a large quantity of down.

15. Salix *(hastata)* foliis serratis glabris subovatis acutis seſsilibus, stipulis subcordatis. Lin. Sp. Pl. 1443. *The Hastated Willow.*

This is a middle-sized tree, sending out several long green shoots from the stools, which are very full of pith, but nevertheleſs tough and useful for the basket-maker. The leaves are nearly oval, acute, smooth, serrated, sit close to the branches, and have very broad appendices to their cases. The flowers are an oblong yellow-catkin, and come out in the spring from the sides of the young shoots.

The WILLOW belongs to the claſs and order *Dioecia Diandria*, having male and female flowers on separate plants, and whose male-flowers have two stamina. The flowers of that species called the Sallow make their appearance about the eleventh of March, and the leaves are out by the seventh of April. The leaves of the Weeping Willow appear about the first of that month; and the buds of the White Willow swell about the tenth. By the eighteenth, the leaves are quite out, and the flowers full blown. The catkins of the Sallow are formed about the fifth of October.

The Willow, Sallow, and Ozier, from the quickneſs of thier growth, naturally claim the attention of such Gentlemen as have lands suitable to their cultivation; and indeed the immediate profit that they yield makes them a desirable object of attention. In order to raise a bed of Oziers, the ground should be dug over, or ploughed; but where expense is not a consideration, the preference should be given to the spade. The cuttings must then be procured; and although they should consist chiefly of the true Ozier kinds, yet other sorts must be introduced into the Ozier bed to make it complete, and more useful to the basket-maker, who will want the different sorts for the different purposes of his trade. Besides the true Ozier, of which the plantation is chiefly to consist, there must be the Sallow, the long-shooting Green Willow, the Crane Willow, the Golden Willow, the Silver Willow, the Welch Wicker, &c.; by which names they are best known.

The cuttings should be of two years wood, though the bottom parts of the strongest one-year shoots may do. They ought to be two feet and a half long, a foot and a half of which should be thrust into the ground, and the other foot should remain for the stool. These cuttings should be put in at two feet two inches distance each way; and all the summer following the weeds must be kept under; the summer after that, the tallest of the weeds should be hacked down. The Willows must continue growing for three years, when they should be all cut down to the first-planted head. They will sell well to the hurdle-maker; and there will be a regular quantity of proper stools left, to exhibit an annual crop of twigs, which will be worth five or six pounds, or more, per acre, to be sold to the basket-maker. But the price of the twigs is greater or leſs, in proporton to the nature of the situation. Watery ground, by the sides of navigable rivers, planted in this manner, will produce a greater price per acre; because near such places there generally reside a number of basket-makers, who, having the conveniency of water-carriage, can send their work with more ease to distant places.

Plantations of these kinds may not only be regularly made to great advantage on watery ground, and by the sides of rivers, but the very islands, or any part where there is mud or earth, may be planted this way, to the great profit of the proprietor. And here suffer me to give one caution in the planting of these places: Let the rows, which should always run the same way with the stream, be at a greater distance from each other, and the cuttings proportionably closer in the rows. I advise the distance of the rows to be greater in these places, that the floods may have free liberty to carry off the sludge, which would otherwise be detained to the prejudice of the sets. Plantations of Willows to be cut down every six or seven years for poles, should be raised in the same manner, remembering that the sets should be placed at a greater distance, viz. one yard; but when designed for hurdles, to be cut every second or third year, the distance need not be so great.

In order to raise a Salictum, or Plantation of Willows for timber, the ground must be dug or ploughed; and the cuttings for this purpose should be of the last year's shoot. They ought to be a foot and a half long, and a foot of each should be thrust into the ground, at the distance of three feet each way. The latter end of May, or the beginning of June, the plantation should be looked over; when such sets as have shot out too luxuriantly should have all the branches removed, except the strongest leading shoot. All this summer and the next, the weeds must be kept down; afterwards the trees will demand no farther care till the time of thinning, which will be in about five or six years. When the branches interfere with each other, the weakest tree should be grubbed up and taken away, to make room for the remainder, In five or six years more they will require a second thinning. In this manner they must be thinned as often as they touch one another, till the trees are arrived to their full maturity. By planting the cuttings a yard asunder at first, and afterwards thinning of them, they not only draw each other up, and by that means aspire to a great height, but the plants taken away to make room for the strongest, will bring in a considerable profit when sold as poles.

The sorts used for plantations of these trees have hitherto been the common White and Red Willow. These, however, seem now to give place to other kinds which have been lately introduced.

Sets proper to be planted by the sides of ditches, &c. for pollards, should be nine feet in length, two feet and a half of which must be thrust into the ground, having first prepared the way by driving down a crow, or some such instrument, to prevent the bark from separating from the stem. After they are planted, they should be thorned from cattle; and in five or six years they will be fit for lopping; and thus they may continue to be lopped every fifth or sixth year, to the improvement of ditch-sides, water-gutters, &c. were it only for the fuel, as it emits little smoke, and is remarkably sweet; it burns pure and clear to the last, and therefore proper for ladies' chambers, and such people as are curious in procuring the sweetest sorts of firewood.

Willows may be planted in the autumn, but the spring is the surest season. The planting, however, should not be delayed later than February, as the shoots of the succeeding year would not only be retarded, but the stools from whence they were taken greatly injured.

Amongst the ancients, the Willow was appropriated to many uses, but it was chiefly cultivated for binders, to be employed in the vineyard. With them, every thing that regarded the cultivation of the Vine was attended to with scrupulous exactneſs; and Columella, when describing the different things requisite for the vineyard, emphatically styles Willows, Reeds, and Chesnut-trees, " the dowries" for vineyards. Of Willows, binders were made; Reeds made frames; and Chesnut-poles were employed for props. The quantity of land required for each of these is thus described by Columella. One acre *(jugerum)* of Willow-ground will raise binders sufficient for twenty-five acres of vineyard. A single acre planted with Reeds, is sufficient for furnishing frames for twenty acres; an acre planted with Chesnut-trees is enough for propping as many acres as an acre planted with Reeds can furnish frames for. Lib. iv. cap. xxx.

The ancient Britons used boats made of Wicker, covered with skins, for paſsing rivers and arms of the sea:

Primum cana Salix madefacto vimine parvam
Texitur in puppim, cæsoque induta Juvenco,
Vectoris patiens, tumidam superemicat amnem.
Sic Venetus, stagnante Pado, fusoque Britannus
Navigat Oceáno.——————————
LUCAN.

Besides these boats, our rude forefathers knew how to make baskets of Wicker, which were held in estimation even at Rome. Of these Martial says,

Barbara de pictis veni Bascauda Britannis:
Sed me jam mavult dicere Roma suám.

ESSAY VII.

On the Economy of a Park.

IT has been generally supposed, that a deer-park is an expensive article of luxury; and, I confeſs, I myſelf was much impreſsed with that opinion: in order, therefore, to ascertain the amount of my annual expenditure in that article, I directed an exact account to be kept of the profit derived from my small enclosure, setting against it the estimated rent of the land, taxes, cost of labour, people's wages, cost of maintaining the pales and temporary fences, &c. The result, I confeſs, surprised me; for it appeared to me, after three years trial, that, reckoning the venison I kill at the price at which I could sell it to the dealers in that article in London, I am regularly a gainer by holding it in hand.

The extent is about 340 acres of moderate land, as will appear by the rent set upon it. The stock of deer is meant to be confined to 300 head; but the keeper is seldom content with that quantity: the annual slaughter should be about twelve brace of bucks, and six of does and haviours.

For the profit and loſs see the following pages.

The Revesby Park account from Michaelmas, 1801, to Michaelmas, 1802.

Rent and Expenses, Dr.

Rent and parochial rates.	*£.*	*s.*	*d.*	*£.*	*s.*	*d.*
To one year's rent	209	7	2½			
To parochial rates at 5s. 9d. per pound	60	3	9			
				269	10	11½
Sheep.						
To 25 Derbyshire sheep at 28s. each	35	0	0			
To a man's time and expenses driving the same from Derbyshire to Revesby	2	18	1½			
				37	18	1½
Beasts.						
To 6 Scots, at 7l. 7s. each	44	2	0			
To beast farrier	1	1	0			
				45	3	0
To the park-keeper for one year's salary				40	0	0
Hay.						
To mowing 100 acres of graſs, at 3s per acre	15	0	0			
To earnest	0	5	0			
To making hay, and stacking the same, at 4s. 6d. per acre	22	10	0			
	37	15	0			
Dr. Carried over				£392	12	1

The Revesby Park account from Michaelmas 1801, *to Michaelmas* 1802.

Profits. *Cr.*

Deer.	£.	s.	d.	£.	s.	d.
By 10½ brace of bucks, slaughtered at 18l. per brace	189	0	0			
By 1½ brace of haviour bucks, at 18l. per brace............	27	0	0			
By 4¼ ditto of does, at 8l. per brace	34	0	0			
				250	0	0
Beasts.						
By the milk of 5 cows for 40 weeks, at 14 pints each cow per day, being 19600 pints at ½d. per pint........	40	16	8			
By 6 Scots, worth 13l. 13s. each	81	18	0			
By the agistment of the red sheet bull, 52 weeks, at 2s. per week	5	4	0			
By the agistment of 3 heifers, namely, Patty and 2 black ones, 52 weeks each, at 18d. per head, per week	11	14	0			
By the agistment of 2 heifers, Gipsey and Primrose, 2 weeks and 5 days, at 18d. per head, per week	0	8	1½			
By Mr. Bonner for a calf	4	14	6			
By Mr. Roberts for ditto	1	1	0			
				145	16	3½
Sheep.						
By 25 Derbyshire sheep, at 2l. 2s. each................	52	10	0			
By 3½ tod of wool, at 35s. per tod.......................	6	2	6			
				58	12	6
Cr. Carried over..............				£454	8	9½

The Beverly Park Account from Michaelmas 1
to Michaelmas 1802.

Rent and Expenses, Dr.	£.	s.	d.	£.	s.	d
Brought over				382	19	1
Hay continued.	37	15	0			
To the team, occupied in leading the hay, 10 days, at 10s. 6d. per day	5	5	0			
Thatch for the stacks, 7½ hundred, at 12s. per hundred	4	10	0			
For thatching the same, 10 days, at 15s. per day	2	10	0			
				50	0	
Sundries.						
To mowing the thistles and rushes in the park				5	0	
To repairs of the park fencing; the circumference thereof is 750 roods, which to go round in 40 years, gives 18¾ roods of park fencing, to be done in each year, at 2l. 4s. 4d. per rood				41	11	
To trays for fencing off the meadow in the park, being 43 dozen, and admitting them to last 10 years, gives 4¼ dozen to be made in each year, at 4l. 10s. per dozen				19	2	
Improvements.						
Paid William Dickinson for cutting an underdrain in the park, being 3 feet in depth, 96 roods, at 1s. per rood				4	16	
Sinking the outfall				0	8	
To miscellaneous expenses, at 1 per cent				5	2	
Total rent and expenses				£516	5	1

The Revesby Park account from Michaelmas 1801, *to Michaelmas* 1802

Profits. Cr.	£.	s.	d.
Brought over	454	8	9½
Horses.			
By the agistment of 13 horses, namely, 6 saddle horses, 1 two-year old colt, and 6 waggon horses, 52 weeks, at 2s. per head per week	67	12	0
By ditto of 2 yearling colts, 52 weeks, at 18d. per head, per week	7	16	0
By ditto of Brisk, from October 10, 1801, to March 14, 1802, being 22 weeks, at 2s. per week	2	4	0
By ditto of 2 horses, namely, Sturdy and Sir Joseph's poney, from October, 10, 1801, to June 11, 1802, being 35 weeks, at 2s. per head, per week	7	0	0
By ditto of 6 coach horses, from October 10, 1801, to Nov. 1, being 3 weeks, at 2s. per week, per head	1	16	0
By ditto of 4 coach horses, from August 27, to October 10, being 6 weeks and 2 days, at 2s. per head, per week	2	10	0
By ditto of 4 horses, namely, 2 coach horses, the poney and Sturdy, 2 weeks, at 2s. per head, per week	0	16	0
By ditto of the keeper's 2 horses, 52 weeks each, at 2s. per head, per week	10	8	0
By ditto of 3 persons' horses, namely,			
J. Crow's mare, 5 weeks, at 2s. per week	0	10	0
Mr. Foster's ditto, 3 ditto, at 2s. per do.	0	6	0
Mr. Alford's ditto, 9 ditto, at 2s. per do.	0	18	0
By hay eaten with strangers' horses, 8 loads, at 30s. per load	12	0	0
Total profits, Cr.	568	4	9½
Deduct rent and expences, Dr.	516	5	10
Clear gain	£51	18	11½

ESSAY VIII.

On Planting.

As I had long entertained a favourable idea, founded upon observation and experience, of the great profits, as well as national utility, of planting; and being determined to go upon a large scale, both for the important article of shelter, as well as for the great saving in point of fencing, my plan being to plant a thousand acres, I spent some time in looking out for a proper subject. The great objects of my researches were, first, to find a good internal market for the sale of my wood, and if it so happened, an opportunity of exporting it to distant markets; secondly, to find in such a neighbourhood an easy purchase of a large tract of freehold land, of such a quality as rendered it of little value for producing corn or graſs, and at the same time not unfavourable for the growth of wood, and containing good resources for making proper fences, and erecting buildings, &c. for protecting it. I was at length happy enough to find a subject that promised all those advantages, the quantity of acres excepted, which I could not meet with upon so large a scale as I wished; my first purchase being no more than two hundred and twenty-seven acres: but as it lay in the internal part of a large common of seventeen thousand acres, which was then dividing by Commiſsioners under an Act of Inclosure; and as that part of the common, from its quality and situation, was not likely to become an interesting object to the circumjacent proprietors, who bordered upon this large tract, and whose property in general lay at a distance from it; I had good reason to believe, that I could accomplish my plan, by purchasing near at hand what I had occasion for at an easy rate; and I had some time afterwards an opportunity of buying three hundred acres more within the shelter of my first purchase; both which lay within the vicinity of the great national coal-works, of which Newcastle is the port for exportation: and also within a marketable distance of a large tract of country, through which runs the river Weare, abounding with lead-mines, which, together with the collieries, create an immense consumption of wood; particularly small wood, the growth of a few years: there is likewise a considerable demand for wood for many other purposes, especially for charcoal.

Many of the natural woodlands, in the county of Durham, were almost exterminated, owing to the indiscriminate mode of cutting them, and the shameful neglect of the fences, which exposed them to the constant ravages of cattle, making wood a very scarce and dear article in the country. With these advantages before me, happy in the prospect of benefiting my family, and serving my country, in a way so agreeable to myself; about ten years ago I began to inclose my first purchase with a stone wall near six feet high, which was accomplished the same year; I also built several cottages, for the protection of my plantation, as well as for the reception of my work people.

The ground of this plot, whilst in a state of nature, was covered over with ling, fern, broom, and bad graſs, and rushes in the wet places; the high parts of it very bad land, of a channelly quality, and not many inches from a grit-stone rock: lower down the hills, the land is of a better quality, affording a tolerable depth of soil, but was then very cold and swampy, for want of draining. The features of this inclosure are rather gentle than bold, inclining from the north and south, down to a narrow valley in the middle, which continues from east to west, through the adjacent country; over which a small but petulant trout-stream wantonly meandered in so many ridiculous mazes, as choaked its own progreſs, and rendered the whole of this small valley, containing about eleven acres, of my best and most sheltered land, almost useleſs.

My first attention was applied to the conducting it through the ground in an easy curving line, filling up the many circumvolutions it had made in its former paſsage; after which, as several springs were contained within it, I laid stone conduits to conduct them off to the new water-course; these were made nine inches deep within, six inches wide, and laid one foot below the surface, that the trees which are planted upon them, might have room to vegetate.

I next proceeded to the paring and burning its rough and wild surface of rushes, &c. and to the levelling a great number of hillocks that had been thrown up by the water at the time of floods; after which, I trenched up the whole to the depth of eighteen inches, keeping the ashes raised by burning to the depth of about six inches from the surface, that they might the better promote the vegetation of the young plants; and having reserved about three acres for a nursery, which was stocked with a large quantity of young seedling trees, purchased for the purpose, I planted the remainder, with the common basket ozier, and other aquatics. The expense of the whole of this improvement was considerable; but so much land may be truly said to have been made for ever, out of a marsh of rudeneſs, which yielded no profit to its owner. The new water-course formed an excellent conductor, not only to the stone drainage made in the valley itself, but also much aided my subsequent operations in the draining the sides of the hills, from which large currents of water were collected, and brought into the new cut; so that it has since answered in a double capacity.

In carefully examining the boggy parts of the rising grounds, I found the land of two different qualities, which appeared to be swampy from different causes. The first part which fell within my observation, and which contained the greatest quantity of land, was a light hazel earth, mixed with stones, had an open grit stone rock at the bottom, which lay at unequal depths from the surface; out of which iſsued out many very strong springs, some of them making a very singular appearance above ground, from a kind of scum, or moſs, that annually vegetated on the surface of the water; and which, in the course of time, in some degree dammed up the current, and, as it accumulated into a maſs, carried up the water along with it, which constantly kept discharging itself out of the sides of these spungy quaking hillocks, many of which had arisen to a considerable height, and had often proved the graves of animals, as appeared from the many bones that were dug up, whilst my people were cutting the drains. It was therefore evident, that the bad condition of this part of the ground was caused by springs only; these were easily taken off, by digging at their head or source, down to that level where the water boiled up and formed one collected stream, from which my cuts were made, sufficient to contain a stone conduit, fifteen inches deep, and six inches wide, allowing the top of them to be one foot below the surface of the ground: all those conduits were directed down the sides of the rising grounds, in a direction north and south, to the new water-course, in the valley below.

The other kind of boggy land, the quality of which engaged my attention, appeared plainly to proceed from the toughneſs and tenacity of the ground, being a strong soil at the top, with a cold clay bottom, under which lay a close-bedded rock, whose interstices were also filled with clay. This kind of land seldom contains any springs, and none were found therein; it therefore became wet, from the rain-water not being able to find its way through it. This turned out a much more difficult subject to improve, than the loose springy ground above described, as covered drains made with stones would have no effect: the only alternative left me, was to make a number of small open drains, about two feet deep, one foot wide in the bottom, and two at the top, and to carry the same longitudinally along the ridges of the rising grounds, the better to intercept the water in its paſsage downwards, and which I afterwards conducted to the new water-course, by some few general drains cut at right-angles to the former ones.

Having completed the inclosing and draining my ground, my next busineſs was the paring and burning about eighty acres more of the deepest land; and after the ashes were spead over the surface of it, I trenched the greatest part of it with the spade, to the depth of fifteen or eighteen inches; the rest was ploughed very deep: the latter I found the cheapest method, and nearly as efficacious as the former. I then began to plant, making choice of the autumn, for the high and barren parts; and the spring for the lower and deeper land. On the former subject, I chiefly confined myself to the planting the hardy natives of mountainous countries; such as the Larch, Pine, and Fir kind, Birch, Geen Tree, and Mountain-Ash, with some others; all which, for the sake of shelter, I planted at two feet asunder.

Upon the lower and more fertile ground, part of which was prepared as above decribed, I planted trees of a more permanent growth, most of which would produce a new succeſsion from the root after cutting; such as the oak, ash, elm, sycamore, beech, and western plane; and in the moist ground, the alder, poplar, and Norfolk willow. These trees were planted at proper distances, to make a timber wood; and in the intermediate spaces, by way of shelter as well as profit, all the mountain kinds, as above mentioned, were introduced; most of which, except the larch and geen tree, are intended to be weeded out, after they arrive at saleable age, to make room for the timber-trees. In this part of the ground, the trees were planted at a yard distance.

It is well known that the resinous kinds, such as larch, pine, and fir, are more rapid in their growth, will grow upon worse land, come to profit sooner, and afford more shelter than the generality of the other three; but it should be always considered, that they never spring again after cutting; so that in the course of a few years they arrive at maturity, must be cut down, and you have the melancholy prospect of being again presented with a dreary waste.

As I propose those kinds, the larch excepted, to remain for timber only, in the highest and most barren parts of my plantations, that it may never come under so unpleasant a description, I have there, at proper distances, attentively planted amongst them some hardy kinds, which propagate themselves spontaneously from seed; such as the birch, mountain ash, and geen tree, the seeds of which will be copiously sown, and planted, by the winds and birds, which, nurtured by the fostering shade and warmth of the timber trees, will propagate themselves in every vacancy of the plantation; and thereby replenish the naked ground when the resinous kinds are cut down and removed.

I have long found from observation, that in unsheltered situations those trees thrive best, that are not above one foot or eighteen inches high when planted; as they furnish shorter levers than taller trees, which, by their own force, operating with the power of the winds, are constantly distreſsing the root, by breaking the young fibres, which destroys the progreſs of vegetation; to remedy which, it is common for inexperienced planters to place them so low in the earth as to be in a great measure out of the reach of the solar influence; a practice equally hurtful to vegetation as well as contrary to the mode in which nature plants her own productions: I therefore always pay more regard to the strength of the stem and fibrous state of the roots, than to the height or age of my trees, which were always planted very small, having few luxuriant weeds, or long graſs to stifle or pull them down.

I choose also to intermix the different trees in my plantations, as much as poſsible; not only by way of establishing a succeſsion, in the manner before related; but also from an opinion, that ground so planted will produce more useful wood, and that the earth itself furnishes an heterogeneous maſs of matter, containing the proper food, for different plants to vegetate upon; and that every distinct species draws a peculiar kind of nourishment different from the rest; which is neceſsary for its own support.

If this opinion is well founded, a promiscuous arrangement of various kinds of trees, must be the best mode of disposing them; as each kind will with the more facility search out and obtain its share of proper nourishment, without robbing its neighbours; which being plants of a different genus, will partake of that aliment, which is allotted for their succour. On the other hand, if trees of the same kind, and which draw from the earth the same specific nourishment, are planted very near each other upon the same common bed, they must soon exhaust the soil of that nutriment peculiar to their nature, and must dwindle of course.

I remember an experiment tried some years ago, by Mr. Jones, gardener to the Earl of Darlington, at Raby Castle, which I think throws some light upon this subject: he sowed peas, which is supposed to be rather a meliorating than an impoverishing crop, for ten years together, upon a piece of rich land: the result of this experiment was, that for the two first years the crop was abundant; but after that time, it gradually became more and more puny and meagre, so much so, that on the tenth year of sowing, the earth was so drained of the proper nutriment this plant required, that the peas would not even vegetate within it, but lay till they became putrid; after which, without any previous manuring, he planted strawberries upon the same ground, which produced an excellent crop.

Some species of trees draw their nourishment very near the surface of the earth, and often form a compact web of roots above ground; others occupy the middle stratum; and some there are so hardy as to force their way, not only through the stubborn soil itself, but through stones, rocks, and minerals of all kinds, to the depth of twenty or thirty feet or more; which, without paying any respect to beauty, shows the utility of interspersing plantations with a variety of different trees, that each may have space, not only to find its proper pabulum, but to extend itself to that level it most delights in; and the whole body of soil and understratum, in this case, instead of being partially occupied, will probably furnish nutrition, and become one interwoven maſs of roots and fibres, as far below the surface of the earth as the trees are elevated above it.

Having, in the course of about four years, completed all the above-mentioned works, I began to inclose my second purchase of three hundred acres, with a stone wall of the same dimensions as the former. I also added many convenient buildings to a farm-house, which I found upon the spot; erecting several more cottages, both for the protection of my new plot, as well as to increase the number of my labouring people After this, I proceeded to lay out, about my house, a small, but neat farm; which in a few years will be securely defended from the formidable winds of a naked country, by surrounding plantations of considerable extent.

This farm, as it may be considered the eye of my property, was intended to afford an additional security to my woodlands; also that I might have a future opportunity of keeping some horses, to carry my wood to the neighbouring collieries, lead-mines, &c. as well as to furnish the little colony of cottagers, I have planted and intend to plant upon my new settlement, with cow-pastures, potatoe-garths, gardens, orchards, &c. and also for the facility and pleasure of seeing and killing the game that are secured in the adjacent plantations, and for defending them from neighbouring depredations.

This small farm I subdivided into little fields, with quick-hedges, and trees planted within them; also with belts of wood for internal shelter. I next gave it a thorough draining, with such stone-drains as were made use of in the former plot; I then gave the whole a substantial, though rather expensive cultivation. This ground being nearly similar in quality to the first plot, with this difference only, that the declivities were fewer and rather more gentle, and the aspects not quite the same; I shall therefore not trouble you with the consequent alterations made in the mode of planting it, as they differed very immaterially from what I have before described.

Finding the orchards, in the county of Durham, had been as much neglected as the woodlands, and that there were but few apples to be purchased in that populous neighbourhood, except those that were imported at Newcastle, and other sea-ports; I thought it advisable to mark out some ground for the purpose of planting apple and pear trees. I accordingly made choice of eleven acres, for that purpose, which have been since planted with all the best and most hardy kinds of winter and summer fruit, in a favoured situation, lying to the south, and embosomed by a large tract of new planted wood. I also made choice of and planted some similar situations, upon a smaller scale, amounting in the whole to about fourteen or fifteen acres; which completed the improvements I had planned out for my second purchase, all which were performed in about four more years: the last two have been industriously occupied in replenishing my nursary for the extension of my intended plan of operations, and in renewing with living trees, the vacancies where the first planted ones had died, which were very numerous from the loſses occasioned by a series of bad seasons.

Great attention has also been paid to the eradicating such as did not appear to thrive on particular parts of the ground; and to the replacing them with such kinds as promised more succeſs: this busineſs has been attended to with such a vigilant eye by my fac-totum, at that place, that I believe, out of five hundred and twenty-seven acres, my small farm included, there is not a yard square of my whole ground but what is occupied by some useful or ornamental plant; there having been planted and replanted above four million of trees; amongst which, besides the profitable kinds that have been mentioned, I hope my posterity will pardon (as an involuntary error in an admirer and student of nature) the foible of encumbering the ground with many thousand shrubs and plants, which can only furnish beauty to the eye of taste, and food to the feathered generation.

I have constantly paid an annual visit to my improvements in the county of Durham; ever since they began, until the last two years, I was prevented by the pursuit of my profeſsional engagements. The last autumn, however, I had an opportunity of seeing them, on my road to Scotland. The trees in the first plot, being well rooted in the earth, had made very rapid shoots. I must acknowledge it gave me much pleasure to see so large a surface of wood elevated some feet higher, since my last visit; and I rejoiced to see the sombre unprofitable heath for ever banished, by a gay succeſsion of thriving trees, in their autumnal liveries, now sufficiently high to shelter the planter from inclement winds, and rising very fast into property and perfection. My plantations already begin to be an asylum for the game; the pheasants, hares, &c. from distant woods, have discovered a new retreat.

The trees in general flourish very well in both plots, particularly the larch, birch, geen-tree, Scotch fir, and mountain ash; amongſt which the former distinguishes itself very much, being in all places considerably larger, and in some near twice the size of any other kind; and it appears also to afford a very salutary shade and shelter to those trees that partake of its influence. This convinces me of a great error I have committed, in planting ſcotch firs, by way of nurses, which do not appear to answer the intended purpose of advancing the growth of the other trees; on the contrary, I find them great tyrants amongst their neighbours, from the strength and great extent of their branches; also from the close covert of the leaves, which not only exclude the air, but prevent a due admiſsion of the rains.

The larch is not only superior in beauty and hardineſs, but furnishes more durable and valuable timber; and is likewise a more tender and friendly nurse to more delicate trees, being furnished with a small number of small pliant branches well garnished with leaves; and which, from their flexible quality, will yield and give place to the adjacent trees, and are not subject to lash and buffet them: they also more readily admit the rains, than the ſcotch fir, and are not liable to receive injury in snowy seasons, when the branches of the latter are frequently mutilated, and the trees sometimes totally destroyed; the effects of which I have too fatally experienced.

I think it is probable other planters may have been often misled by a mistaken idea of the superior hardineſs and nurturing quality of the fir; or, from not being acquainted with any other more proper tree to substitute in its place, have adopted it; or I should conceive, they would not have planted such numbers of this truly gloomy and unpleasant plant. In respect to shelter, it must be allowed to contribute in the winter more than most others, particularly the deciduous kinds; but as far as relates to the propagation of the plantations themselves, I am of opinion that internal shelter at this dreary season, when the powers of vegetation are totally locked up, is of much leſs consequence, than in the more genial months, when the trees are making their shoots; the internal warmth of a plantation must then greatly facilitate the operations of nature, and the larch, being one of the most early trees we have in the spring, is at that time in full foliage; and I consider it the most promising tree I have met with to aid her in that neceſsary work; and as I find it not easy to separate pecuniary gratifications from those of taste, notwithstanding my general dislike to the Scotch firs, I am not so much their enemy, as totally to exclude them from my plantations, as the sable hue produced by their foliage, has a good effect, when properly interspersed and blended with the more vivid tints of other more pleasing and lively trees: I shall, besides those that are intended to remain for timber on the barren parts, leave a number of them upon my best ground, for the purpose of decoration: the remainder I am now exterminating with all poſsible vigour.

The larch, I have found by experience, will thrive where few other plants will live. The birch, though no timber-tree, is a useful wood, affords great shelter, and is almost as hardy as the larch, as I have fully proved at Butsfield plantations, which, in its uncultivated state, had several roads over it, some of which, that lead down the declivities of the hills, had all the soil washed from them by the torrents, nearly to the rock: those roads were planted with small trees of different kinds, making use of a pick-axe to form the holes for their reception: I also planted up all the old quarries, where stone had been got, in the same way. There being no soil, I brought a small portion of earth to each plant; and, upon those unfavourable spots, where most of the other trees had died, these plants appear to flourish as well as upon a better subject.

When I consider the many virtues of that invaluable and pleasing tree, the larch, I think it a great misfortune that its introduction into this country was not of an earlier date. About fifty years ago I am told this Alpine plant was treated as a tender exotic, and planted out, with the utmost care and diligence, in our hot-beds and hot-houses; I am every day more convinced of its utility, both from domestic and foreign intelligence.

I must observe, that though there was not a single tree or bush upon either of my purchases, before I began the improvements, a circumstance soon after happened, which convinced me that wood had grown upon the land; for, in digging my drains, the roots of large trees were found; also upon the surface of the ground, several very large heaps, containing the cinders of iron ore, which metal this country still produces; and it is probable the smelting it, may, in barbarous times, have been the original cause of the present scarcity of wood in some of the northern counties;

as there is a tradition prevails amongst the country people, that the whole of those waste lands was once a great forest; which was all consumed in smelting the ore, by a kind of foot-blast, before the invention of better engines; and that the workmen frequently shifted their ground, as the wood or ore decreased, till they had overrun the whole country.

ESSAY IX.

On the Improvement of waste Lands in the County of Westmoreland.

The uncultivated lands in Westmoreland are of various sorts, with respect to soil and situation, and capable of different sorts of improvement. Some of them consist of extensive commons in low situations, and are of an excellent soil; these might be improved by inclosures, without any risk of loſs by the undertaking. Others constitute extensive mountainous districts, called by the natives *fells* and *moors;* the soil of these is, generally speaking, an hazel mould. In its natural state, it produces little else than a coarse benty graſs, heath, and fern; or, in the language of the country, *ling* and *brackens*. Many of these fells are, in their present state, of so little value, that the liberty of keeping ten sheep on them may be hired for sixpence a-year. Supposing six acres to be sufficient for the maintenance of ten sheep, the rent of such land is a penny an acre; and the price of the fee simple of it, at twenty-four years purchase, two shillings. Whilst there is an acre of such waste, improveable land in Great Britain, it may be hoped that, when the legislature shall turn its attention to the subject, no inhabitant of the island will be driven by distreſs, to seek a subsistence in Africa or America.

Above forty years ago an experiment was tried in Spain, with respect to the cultivation of waste lands. Several thousands of poor and vagabond people were settled on them at the expense of the government. If this experiment has succeeded (which may be easily known,) so far, as that the land has been made productive, that the settlers have been increased, and that the government has been reimbursed the whole or a principal part of its expense, it may induce other governments to adopt the same or a similar plan. The giving a cottage, and a few acres of land, under a small reserved rent, and perhaps under other useful restrictions, to a poor man, is certainly a good way of improving the land. When a man has lands of his own, he and his family will exert in its cultivation, a quantity of labour which would not otherwise be brought into existence. The value of this, otherwise non-existing labour is, in one respect, nothing; it ought not to be reckoned as a part of the expense attending the improvement of the land; and, on that account, many thousands of acres of land might be brought into cultivation, which would not, in any other way, pay the expense of improvement. The manner of improving moor-land, by paring, burning, liming, &c. is well understood by some few individuals, and the advantage resulting from it ascertained, by what has been recently practised in some parts of the county on private estates.

There are many barren mountains in this county which do not admit improvement by paring and burning, and which are incapable of being profitably converted either into arable or good pasture land: yet the highest and most craggy parts, two acres of which do not afford sustenance for six months in the year to one sheep, might, with a great prospect of ſucceſs, be planted with larches; I say with a great prospect of ſucceſs, for I do not speak with certainty, not knowing whether there are in Great Britain any plantations of larch made on such exposed and rocky situations as are here spoken of: But, on the other hand, it is known, that the larch grows in Italy on higher mountains than any that we have in this island; and not only that it grows in Italy, where the climate is leſs severe than in Great Britain, but that it grows in the north of Ruſsia, where it is much more severe; for at Archangel, in the latitude of 64°, ships are built of larch growing in that climate.

It may be of use to state the probable profit which would attend planting the land in question with larch. A thousand acres of this sort of land might be inclosed with a circular wall six feet in height, (where the stones can be easily gotten, as they may in most parts,) after the rate of six shillings an acre, or 300l. for the whole; five hundred larches two feet in height, (so as to enable them to resist the long graſs,) might be planted on each acre for fourteen shillings; hence a plantation of 500,000 larches might be made for 1000l. Now 1000l. improved at compound interest, at the rate of 4l. per cent. would, in sixty years, amount to the sum of 10,519l.; this is the accumulated loſs attending the inclosing and planting 1000 acres of rocky land in sixty years. The rent of 1000 acres, at one penny an acre, is 4l. 3s. 4d. a year; in eight years the larches would be out of all danger from sheep, so that the loſs of rent ought only to be estimated for eight years; but 4l. 3s. 4d. a year, though improved after the same rate of compound interest, would not amount to 40l. in eight years; say, however, that it would amount to 81l. which is allowing more than two pence an acre for the annual rent of the land, then would the whole expense attending the plantation in sixty years be 10,600l. If the amount of 81l. for 52 years, be taken into consideration, the expense of the plantation in 60 years will be 11,222l. I have here supposed sheep to be shut out of the plantation for eight years; if it should be found, that sheep will not crop the larch, and from more than one observation, I have reason to believe that they will not, they need not be shut out at all; nor, on districts, where nothing but sheep are depastured, need any fence be made. I know the advocates for close planting, instead of 500, would require 5000 larches for each acre; I am not convinced of the utility of such close planting, except where it is intended to nurse up oaks, or other kinds of wood; but if that mode should be adopted, the thinnings, after twenty years' growth, would pay the expense of it. At the expiration of sixty years, suppose that only 250 larches remained on each acre, or that one half had perished; the probable value of them may be thus estimated. From a great many experiments made by myself and collected from others, I find the annual increase in circumference of the larch, at six feet from the ground, to be one inch and one half on an average of several years; and this inference has been drawn from the actual admeasurement of larches in different parts of England and Scotland, and of different ages, from ten years old to fifty. On this supposition, the larches would measure, one with another, ninety inches in circumference, at six feet from the ground. A larch which measures ninety inches, at six feet from the ground, would measure above seventy at twenty feet from the ground; but supposing seventy inches to be the circumference at twenty feet, and the length of the tree to be forty feet, neglecting the remaining top; then will its solid content be eighty-five cubic feet, and the value of the tree, at nine-pence a foot, above three guineas. But as the trees are supposed to be planted in a high, bleak, barren situation, their annual increase may not be so great as is here supposed: instead of being worth, at sixty years after planting, three guineas a piece, admit that they are worth only ten shillings each, then would the whole plantation be worth 125,000l. and deducting the whole expense, 10,600l. as before estimated, there would remain a profit of 114,400l. The present value of 114,400l. to be received sixty years hence, is above 10,000l. (interest of money at 4l. per cent.) Ten thousand pounds at 4l. per cent. purchases an income of 400l. a year: by planting then, a barren estate, of a thousand acres, is improved from 4l. 3s. 4d. [illegible] 00l. a year, reckoning the value of a [illegible] as a present certainty. Sixty [illegible] part of the life of a man; but [illegible] thing in the [illegible] a family.

which is a little nation. The waste lands in this and other counties, are a public treasure in the hands of private persons; all of them ought to be converted into arable, meadow, or pasture land, which are capable of admitting, with profit, that kind of improvement: and such of them as will not pay for that mode of improvement, ought to be covered with wood; the high parts, and especially the sheltered dells in the high parts, with larch, and the lower with oak, ash, &c. When a spirit of agricultural improvement is fully excited, the individuals to whom such uncultivated lands belong, will be prompted, by an attention to their own interest, to forward every judicious plan which may be proposed, for rendering them more useful to the proprietors and to the community; their present application to the summer-maintenance of a few miserable sheep, ought not to be persevered in, if any other use can be made of them.

ESSAY X.

On Coppices in the County of Westmoreland.

IN some parts of Westmoreland, considerable portions of land are covered with coppices, consisting principally of oak, ash, alder, birch, and hazel. These underwoods are usually cut down every sixteenth year: The uses to which they are applied are chiefly two—hoops and charcoal. The hoops are sold in the wood at 5l. a thousand; they are generally manufactured in the country, and sent by sea to Liverpool; the charcoal is sent to the iron furnaces in the neighbourhood. The value of a statute acre of coppice-wood, of sixteen years growth, is variable from 10l. to 15l.; and if it consists altogether of oak, its price may amount to twenty guineas; 6l. for the charcoal, and 15l. for the bark; it being the custom here to peel the bolls, and all the branches of the oak, which are equal to the thicknefs of a man's thumb.

It is an extraordinary thing, to see any trees left to stand for timber in these underwoods, the high price of bark being a temptation to cut the whole down. Fine saplings, from nine to twelve inches in circumference, at five feet from the ground, and with bark as splendid as polished silver, are felled by the unfeeling proprietor, with as little regret as if they were thorns or briars. Of late, indeed, some few owners of underwoods have left standards, and if they consult their interest, the practice will become general. As this is a point denied by many proprietors of coppices, it may be of use to explain the principles on which the observation is founded.

Suppose a statute acre of underwood to be, in the spring of 1794, sixteen years old, and that the whole is then cut down and sold for 14l.; this sum will, in sixty-four years, (reckoning compound interest at 4 per cent.) amount to 172l. In 1810 another fall of underwood, of the same value, will be made; the 14l. then arising, improved for forty-eight years, in the same way, will produce 91l. In 1826 another 14l. will arise from another fall of the underwood; this sum, improved for thirty-two years, will amount to 49l. In 1842, another fall will produce 14l. which, in sixteen years, will become 26l. And lastly, in 1858, or in sixty-four years from 1794, another fall will produce 14l. The amount of the value of the five falls, thus estimated and improved, will be 352l. Let us now calculate the profit which would result, in the same time, from the same acre of underwood, if it was managed in a different way. Instead of cutting the whole down in 1794, let us suppose that 150 of the best young oaks are left to stand for timber; the then value of these, at 2d. a tree, is 25s. this being subducted from 14l. the value of the whole coppice, leaves 12l. 15s. This sum, improved as before, will amount, in sixty-four years, to 156l. (shillings and pence in these calculations being neglected.) The next fall in 1810 ought not to be valued at more than 10l. as 150 trees, then of thirty-two years growth, will do some injury to the underwood: 10l. in forty-eight years will amount to 65l. The next fall in 1826 may be valued at 8l. and at that time seventy-five trees should be taken down; these trees will then be forty-eight years old, and worth 15s. a tree, or 56l. in the whole; this added to 8l. the value of the then underwood, makes 64l. which, in thirty-two years, will produce 224l. Without estimating the underwood in 1842, and in 1858, at any thing, or the value of the pasturage for thirty-two years at any thing, let us suppose the seventy-five remaining trees to be cut down in 1858, being then eighty years old, and that they would, one with another, be worth 4l. a piece, or 300l. in the whole: The sum of the profits, thus arising, is 745l. or more than double the other amount.

It is a general opinion in this, and, I believe, in other countries, that it is more profitable to fell oak wood at fifty or sixty years growth, than to let it stand for navy-timber to eighty or one hundred. According to the price which is now paid for that commodity, either by the Navy-Board, or the East India Company, I believe the opinion to be founded in truth. The following observations contain the reason for this belief.

If profit is considered, every tree of every kind ought to be cut down and sold, when the annual increase in value of the tree, by its growth, is leſs than the annual interest of the money it would sell for:—this being admitted, we have only to inquire into the annual increase in the value of oaks of different ages.

In the Philosophical Transactions for 1759, there are some useful tables respecting the growth of trees, by Mr. Marsham; from these tables the two following inferences may be drawn:—

1st, That it is highly profitable to let young thriving oaks, which are not worth above 30s. a tree, continue standing.

2d, That it is not profitable to let oaks of 80 or 100 years growth, continue standing.

Three oaks, marked in the tables, No. 8, 11,—12, in April 1743, before they began to shoot, contained eleven and one half feet of wood, and were altogether worth, at eighteen pence a foot, bark included, 17s. 3d. The same trees, sixteen years afterwards, contained thirty-four and one half feet, and were worth 2l. 11s. 9d. Now, if 17s. and 3d. had been improved at the rate of 7 per cent. at compound interest for sixteen years, it would not have amounted to 2l. 11s. 9d.; and of consequence the proprietor, by letting such oaks stand, improves his property in as high a degree, as if he put out his money to interest at near seven and a half per cent.

Three oaks, No. 2,—3,—5, in 1743, contained 100½ feet of timber, and were worth 7l. 10s. 9d. The same trees, sixteen years afterwards, contained 132½ feet, and were worth 9l. 18s. 6d. Now 7l. 10s. 9d: the value of the trees in 1743, improved, at the low rate of interest of 2l per cent. would, in sixteen years, amount to a sum exceeding 9l. 18s. 6d. The proprietor, then, by letting such trees stand, does not improve his property at the rate of 2l. per cent.

The oak, No 1, in the third table, was worth 1l. 2s. 6d. in 1757, it gained in one year one foot, or 1s. 6d. in value; if it had been worth 30s. and had gained one foot, there would have been no profit in letting it stand, as the interest of 30s. at 5 per cent. would have produced 1s. 6d. in the year; and it is for this reason that I have fixed upon 30s. as the value of trees which should be cut down; if they are cut sooner or later, the proprietor will be a loser. It must not be supposed, however, that great precision can attend this observation; since particular soils, or the greater or leſs thriving condition of the wood, may render it useful to cut down trees before they are worth 30s. or to let them stand a while longer. It ought to be remarked also, that large trees sell for more per foot than small ones do, yet the usual increase of price, is not a compensation to the proprietor, for letting his timber stand to a great age. This may be made out from the following experiment:

On the 27th October 1792, I measured, at six feet from the ground, the circumference of a very fine oak, of eighty-two years growth, from the time of its being planted, and found it to be 107 inches: On the same day of the month, in 1793, it measured 108 inches.—There is not one oak in fifty (at the age of this) which gains an inch in circumference, in one year. The length of the boll of this tree was about eighteen feet; it contained about eighty-four feet of timber, and was worth, at 3s. a foot, 12l. 12s. It gained in one year very little more than a foot and one half of timber, or 4s. 6d. in value; but the interest of 12l. 12s. at 4l. per cent. amounts, in one year, to above twice the value of the increase, even of this tree, which is a singularly thriving one.

I have been the more particular on this

subject from a public consideration. Many men are alarmed lest our posterity should experience a scarcity of oak timber for the use of the navy; and various means of increasing its quantity have been recommended with great judgment. In addition to these means, the making a much greater than the ordinary increase of price on timber of a large scantling, might be not improperly submitted to the consideration of those who are concerned in the busineſs. If the Navy-board would give 8l. or 9l. a load for timber trees containing 100 cubic feet or upwards, instead of 4l. or 5l. every man in the kingdom would have a reasonable motive for letting his timber stand till it became of a size fit for the use of the navy; whereas, according to the present price, it is every man's interest to cut it down sooner.

ESSAY XI.

On the Improvement of an extensive Farm, containing a large portion of waste and uncultivated Land, and held under a long Lease.

IN the year 1790 I took a lease of an estate of about eleven hundred acres, situated to the north of the western extremity of the Cheviot hills. It had been recently purchased by a Gentleman of great profeſsional eminence, who was well acquainted with the great and lasting advantages that flow from judicious improvement: it is not to be wondered at therefore, that the learned proprietor was not contented with allowing his lands to remain in a state of comparative barrenneſs, under a system of agriculture which had hardly emerged from a state of ancient ignorance; he resolved that plenty should occupy the place of long-existing sterility, and let his estate to me upon an improving lease.

At the period when this lease was taken, the estate was divided into four farms: the lease of the principal farmer was bought up by the landlord, and I entered into the poſseſsion of this part of the grounds at the period already mentioned. Two smaller farms came into my hands, the one of them one year, and the other four years afterward. The lease of the remaining farm expired at Whitsunday 1798; but by the bankruptcy of the farmer, it has been in my occupation since the same term of 1794.

Such being the state of the leases on the estate, my rent was of a progreſsive nature. When I entered into the poſseſsion of the first farm, I paid 270l.; and at the expiration of the lease of the second small farm, my rent was advanced to 297l. It was at this period that I entered on the farm, the occupier of which had become insolvent: I continued to pay his rent until Whitsunday 1798, the time at which it would have regularly fallen into my poſseſsion. At this term my rent rose to 550l. at which sum it continues stationar until the expiration of the first twenty-on years, when it rises to 700l. for the remainin period of the lease.

This progreſsive mode of affixing the r was considered equally advantageous to b landlord and farmer: the former was benefited by getting an increased rent upon the lands which were first occupied, by the augmentation of his rental, in a short period, from 312l. to 550l. and in receiving, besides the great emoluments arising from plantations, a return of seven per cent. during the last years of the lease. The advantage to the occupier of the lands arose from the circumstance, that as his improvements extended, the soils were more able to afford an additional rent.

The estate was in so wretched a situation, that this increase of rent could not be produced but at the expense of great sums laid out upon the improvement of the land. That I might be indemnified therefore for this necefsary expenditure, the term of the lease was made forty years; and at the expiration of twenty-one, the option of two lives was in the choice of the farmer. The landlord, still further to encourage the improvement of his estate, bound himself to advance 800l. in sums of 200l. every six months, to the farmer, to be expended upon the lands; and to give about an equal sum for the erection of a good farm house and farm buildings. The farmer was also allowed a power to sub-let the grounds for any period, not exceeding that of his tenure of the estate.

In consideration of these advantages, I bound myself to manure the whole lands, and to bring them into a state fit for producing corn; except a portion of them, which was in a moſsy, boggy condition. The draining of this moſs was, however, enjoined, as well as the inclosing of the estate. I likewise obliged myself to add about 300l. in carriage and other labour to the sum given for the buildings, and to pay five per cent. for 400l. of this money advanced by the landlord.

These are the principal features of my lease, which I have thought it neceſsary to particularize in this place; they bespeak the most liberal views in the enlightened proprietor, and are deserving attention from their being eminently calculated to excite the exertions of skill and industry in the improvement of waste and unproductive soils.

In commencing the improvement of my farm, the first object that demanded attention, was to shelter the lands in so high and exposed a situation. The surface of the estate is a rising ground, sloping chiefly to the south, and in a leſs degree to the north: the greatest and best part of the land is contained in the southern slope, at the bottom of which is the moſs, formerly noticed. It is sheltered on the south by an opposite higher ground; so that, as the estate is of a pretty regular square form, there were only three sides upon which shelter was required.

A small space upon the eastern extremity of the estate, where it was not thought proper to plant, was fenced with a double ditch and hedge; but around all the remaining exposed border, a plantation of Scotch firs, about a hundred feet in breadth, was made. This plantation was inclosed with turf dikes, calculated to protect the plants for many years; and a similar plantation, extending from one extremity of the estate to the other, was carried along the brow of the hill in a waving line, to shelter the grounds on each side below. The plants are making rapid progreſs towards maturity, and will amply reward the proprietor for his expenses of planting.

These plantations were calculated to afford a general shelter; but over a wide range of surface, more immediate protection was neceſsary. Inclosing is every where highly advantageous and proper, and I cheerfully fulfilled my obligation of subdividing the lands: the mode of inclosing which, of all others, recommended itself for adoption, was that of ditch and hedge.

There were no inclosures upon the grounds, except a few bad hedges in the neighbourhood of the mansion-house, which is situated upon the north side of the estate; the inclosures upon this part of it were completed, and ten square fields, containing about an hundred acres of land, were formed. I expended a small sum of money in manuring a part of these inclosures, and sub-let them, upon a short lease, to a Gentleman who, though previously unacquainted with agricultural pursuits, has nevertheleſs ſucceſsfully improved his farm after the example set him in the improvement of the other parts of the estate.

The lands upon the south side of the plantation running along the high ground, were all subdivided into regular inclosures in the course of the winters 1790 and 1794: the fields vary in size according to the nature of the surface, but the general quantity of ground they contain is about twenty acres. The hedges are all run in strait lines, and all the inclosures are regular squares, except those which are bounded by the plantations, by the double ditch and hedge on the east border of the estate, or by the moſs at the bottom of the hill. The thorns have advanced rapidly in their growth, and many of the hedges are already perfect fences.

This rapidity of growth is to be ascribed to the great attention which was paid to the pulverization of the soil, for a considerable depth; and to the manuring it with lime and rich stable-yard dung, previous to the planting of the thorns. This effect has also arisen from the after-care which has been bestowed upon the plants in keeping them free from weeds, properly pruned, and their roots always covered with earth: for these purposes a hedger is kept upon the estate, at the mutual expense of the landlord and farmer; and when he requires aſsistance, I pay labourers to work under his direction.

Besides this care of the plants, however, much attention also is paid to the protection of the hedges from the injuries they are liable to sustain from the sheep grazed in the fields. The ditch affords a sufficient barrier on one side; but on the exposed side of the hedge there is a neceſsity of running a paling of three bars at the distance of a foot from the thorns: the wood for this paling is given by the proprietor from a plantation of Scotch firs upon the estate; it is erected at my expense, and there is sometimes a neceſsity of renewing it before the thorns have arrived at such a degree of strength as to be no longer obnoxious to injury.

It is worthy of notice that those thorns which were planted the earliest in the season have every where thriven the best.

I shall not unneceſsarily add to the length of this Eſsay, by describing the particular mode of constructing my ditch and hedge; I shall only state that I have made five thousand six hundred and forty-three roods (each rood containing six yards) of this kind of fence; and that this quantity of inclosing, together with the expense of protecting the hedges, has cost me the sum of five hundred and sixty-four pounds.

Having given this account of the inclosing of the principal part of the estate, we are prepared to enter upon the discuſsion of the next subject which claims attention previous to the account of the improvements; viz. the ſtate of the lands and mode of occupation at the time when I entered into poſſeſsion.

Within the last fifty years, the agriculture of Scotland has undergone rapid and extensive improvement: the antiquated and unproductive system of our forefathers has given place to the principles of agriculture which have flourished and been perfected in many parts of the sister kingdom; and in this particular county there are few districts over which improvement has not extended its beneficial influence. In the number of these districts however, was ſituated the estate; the improvements upon which make the subject of this communication. Here Prejudice had fixed his dominion; and after the ancient mode of husbandry, the soils were divided into what was termed in-field and out-field land, and into moor land, meadow, and bog.

The in-field land was that part of the estate which consisted of the richest soil, and in the present instance amounted to about three hundred and thirty acres. It was considered worth a rent of ten shillings an acre, and was managed in the following manner. The land was summer-fallowed, cleaned of weeds, and sown with barley or oats, and sometimes with wheat. The farmers produced, however, very small quantities of the last grain; and their established mode of managing this kind of soil, was to take four or five crops after fallow, and then to repeat the same unproductive system of fallowing and hard cropping: they raised very small quantities of turnip, and these too only during the last years of their occupation of the grounds.

The out-field land was of a poorer quality; a part of it was valued at five shillings, but the greater proportion of it was only rated at three shillings per acre. The quantity of this soil was about three hundred and twenty-five acres; more than two parts of it were always in a state of natural graſs, and the remainder was cropped with oats.

In order to bring this land into a state fit for producing corn, they folded a portion of it with sheep, and ploughed it up in the proper season for oats. They renewed this crop for four or five years, until the land was so over-run with couch-graſs and other noxious weeds, which poſseſs a barren worn-out soil, that it was incapable of producing even the most scanty returns; it was therefore allowed to remain in this waste impoverished state, until it was again folded in rotation: the vegetation of the weed graſs and other weeds produced a barren herbage, and the land was pastured with sheep.

The sheep were grazed in common, upon this out-field land, and upon the moor land, which composed considerably more than a third part of the estate: about a hundred acres of this soil were woodland; and that part of which was in the occupation of the farmers, and amounted to more than three hundred acres, was not estimated at a greater rent than one shilling per acre. It required one acre of the out-field, and four of the latter description of land, to maintain one sheep throughout the year, and that too in the poorest condition. The sheep were always small, and never could be fed fat upon the pasture; the lambs produced from the ewes were equally bad, and at an average were never sold at above five shillings per head.

The produce throughout their farms may readily be conceived to have been of the poorest nature, when it is known that several of the farmers, unable to pay the small rents they held them at, became insolvent, and were obliged to give up their leases to the landlord. It is indeed a subject of wonder how they were able to discharge the most moderate rents; for, with the additional information that the meadow and moſs land was adequate to the maintenance of a few black cattle only, the above relation is a faithful picture of the wretched means they employed to draw them from the lands. By this mode of occupation it must appear how great a proportion of their farms lay in an impoverished waste state at the time when I rented the estate: the best soils produced very poor crops, and the degree of fertility of the out-field land has been already noticed. A great proportion of this kind of soil was lying waste in a state of natural graſs; and there was likewise a considerable quantity of it which had never been subjected to the operation of the plough.

Upon this portion of land, furze, broom, heath, and ling, were the common productions: the moor, meadow, and moſs land, were in a state of nature; nothing had been attempted to meliorate them.

In such a situation, where so much was to be done, and where every spot of land was unproductive or waste, general improvement was an arduous undertaking: I had, however a clear perception of the advantages that would result from my plan of improvements, and resolved to execute them with the necessary spirit and perseverance. How far this plan has succeeded will be afterwards seen; but before we direct our attention to the account of the improvements, it is proper that I should state the nature of the soils which have been the subject of melioration, and premise a few observations upon the labour requisite to the carrying on my operations.

The soils throughout the estate differ greatly in quality, though very little in kind, except in the moor and moſs land: they vary from a dark, heavy, loamy clay, to a light soil of the same nature: the substratum is a free stone rock; the soil of the moor land is a few inches of black moorish earth, upon a stratum of clay; that of the moſs is a deep peat earth. This difference of soils did not prevent me from adhering to a regular plan of inclosure, as I was convinced that improvement would render each soil capable of the same mode of culture, and hence that variations of soil included in the same field would not be productive of inconvenience.

Labour is a part of the expense in the improvement of waste or unproductive soils, which in every situation must prove considerable: the land is incapable of maintaining the quantity of stock that is neceſsary: foreign aſsistance is required; and the improvements are executed at great additional expense.

In carrying on the improvement of my farm, I was much aſsisted by labour, supplied from two other farms, which I poſseſsed at some miles distance. By means of these I was always enabled to keep six draughts upon the improving farm, and frequently ten during the summer. The ploughs and carts are drawn by two horses only, and the ploughmen rank among the most expert in the kingdom: the plough which is in common use, throughout all the improved districts of Scotland, is Small's chain-plough; an engraving of which is given in different agricultural publications. I use it without the chain, and can give my testimony in favour of the general utility of this esteemed plough.

The manual labour always required a number of labourers, besides those employed in ploughing, carting, and harrowing: in estimating the expense of the latter operations, I have made full allowance for the advantageous circumstances under which they were executed.

• When I entered upon the improvement of my farm, it was my object to complete it in those fields which contained the greatest proportion of good soil. The grounds which were under cultivation were improved at leſs expense of labour than the uncultivated lands; but the only difference in the improvement of the various soils, arose from the length of time neceſsary to the pulverization of the waste and moor land. My intention, in every situation, was to bring the soils into a state of fine tilth, and thus render them fit for the reception of manure, and a crop of turnip.

The surface of the lands which had been under cultivation, presented many great irregularities, wet marshy places, and numerous land-stones collected in several parts into heaps. Many of these land stones were of great size, and could not be carried off the grounds: for these, stone pits sufficiently deep to admit of their being covered with fourteen or fifteen inches of mould, were dug; and, as a proper precaution, the pits, when there was a declivity, were sunk at the upper side of the stone. When these stones had thus been removed, and when the wet parts had been succefsfully drained with covered drains, the cultivated grounds were ploughed in the beginning of winter; and by the repetition of this operation, with the afsistance of the spade, every hurtful inequality of the surface was levelled.

The quantity of labour requisite to the pulverization of the soil varied according to the nature of the ground: that portion of the cultivated soils which was managed as in-field land, required three ploughings; but the part of them which came under the denomination of out-field, demanded the quantity of labour which was bestowed upon the same description of land, lying waste in graſs, after it had been cropped with oats.

Upon the improvement of this part of my farm, I shall not be more particular, as the other parts of the proceſs will be comprehended under the account of that of the waste land. I have, however, placed amongst the tables of expenditure, one to show the expense attendant upon the melioration of the best soils.

The improvement of the proper subject of this paper, the waste and moor land, comes now under review; and that I may avoid confusion in the account of this proceſs, I shall divide the grounds into two kinds; viz. into that portion of out-field land which was exhausted and lying in a state of natural graſs; and into that which had never been subjected to the operation of the plough, and was overrun with furze, broom, heath, and ling. In detailing the improvement of the last species of waste land, I shall comprehend under the same head that of the wet marshy ground and moor land.

In effecting the melioration of the first description of waste land, the preliminary steps of land-draining the wet places, and of removing the land-stones which obstructed the progreſs of the plough, were executed*. The last operation was peculiarly neceſsary; for besides the numerous land-stones diffused over the general surface of the grounds, there were great collections of them upon balks, which had been formed by the slovenly husbandry of ancient farmers on the estate: these balks occured over all the lands which were or had been under cultivation.

On the removal of every material obstruction, the land was ploughed with a common furrow in the month of November; and about the end of the following spring it was sown thick with oats. The produce of this crop was always of the poorest nature, and did not make a return of three times the quantity of the seed: it however indemnified me for the labour which had been bestowed upon the ground; and the cropping answered the purpose for which it had been employed.

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* I have this season completed the improvement of a field which contained an astonishing quantity of land-stones. In this inclosure there are the remains of what is believed to have been a Danish encampment; and, upon an adjoining property, there are two out-posts at a small distance. I have completed the filling up of the outer ditch, which time had not perfected, and the peaceful ploughshare now paſses over that spot where erst embattled hosts poured forth terror and destruction.

When I commenced the improvement of this description of land, I fallowed and wrought it for two years: I soon, however, found the error of this practice, and the great expense of labour attendant upon the adoption of it. The soil was choaked with couch-graſs and other noxious roots; and upon lying for even a few weeks, especially in wet weather, the land became nearly as much filled with graſs as when the sward was first broken up. To remedy this inconvenience, I first thought of sowing the ground thick with oats: the effect has answered my expectation; for by the growth of the oats the couch-graſs is prevented in a great measure from springing up, the soil is loosened, and much leſs labour is requisite to its pulverization.

The oats having been removed, the land was again ploughed in the end of autumn, and exposed to the action of the weather and temperature of the winter season in the state of a rough furrow: it was croſs-ploughed in the beginning of April, and afterwards braked* and harrowed. About the end of the same month it was again ploughed, braked, and harrowed; and in May the ploughing and harrowing were repeated. In the course of this labour it was sometimes neceſsary to paſs a heavy roller over the land, in order to break down the firmer clods.

Upon the completion of the last harrowings the roots of the couch-graſs were carefully collected and burnt: the land-stones were removed off the grounds as they were turned up by the plough; and by means of this implement and the spade, every hurtful inequality of the surface was destroyed.

When this labour had been bestowed, the soil was brought into a state of sufficient fineneſs for the application of manure. Before

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* This operation is performed by an implement resembling in every respect a harrow, except that it is larger, heavier, and has longer tines.

I proceed to give an account of this part of the subject, however, I shall previously detail the mode of tillage I employed to bring the second description of waste land into a similar situation.

The furze and broom having been removed off the ground, the draining of the wet places completed, and the larger land-stones carried off, the land was ploughed in November*. The furrow was made about four inches in depth, and allowed to remain in the coarse state in which it had been formed by the plough throughout the winter: the land was croſs-ploughed in May following, and afterwards braked and harrowed. It was again ploughed, braked, and harrowed, in July or August; and after the completion of the last part of the labour, it was ploughed into ridges of nine or twelve feet in breadth. The furrows were well cleaned out by the plough, to prevent the rain water from stagnating upon the lands; and they were again exposed to the influence of the winter's froſt.

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* The broom was sold for fuel; the price received for it, defrayed the expense of its removal, as well as that of the furze.

The furrows were filled up by the plough about the end of the succeeding spring, and the land was again croſs-ploughed and harrowed. After this harrowing, the roots of the ling, and other coarse graſses which had not perished during the eighteen months the land had lain in fallow, were collected into small heaps and burnt into ashes. Upon this incineration the land was for the last time ploughed and harrowed; and those roots which had escaped observation were destroyed by a second burning.

In the course of the labour bestowed upon the grounds, the land-stones were carted off the field as they were brought under observation, and every injurious inequality of the surface was levelled. The land was therefore, by this proceſs of culture, freed from every foreign hurtful substance, and the soil was perfectly pulverised and rendered fit for its combination with manure.

When I had brought the lands into this state of fine tilth, another more expensive part of the proceſs of improvement followed; viz. the manuring of soils, wasted and exhausted of animal and vegetable matter.

The manure which forcibly recommended itself in such a situation, was lime; dung, though in a leſs degree, was also neceſsary and eſsential to the melioration of soils lying in such a condition. I was situated at a great distance from the former kind of manure, but nevertheleſs resolved to use it in a quantity adequate to the purpose for which it was employed; convinced that too strict an economy in this instance would be productive of certain loſs: I had it in my power to command a a sufficient quantity of dung, and raised in the manner afterwards described.

In the application of these manures the quantity was regulated by an attention to the nature of the soils; as these varied from a degree of richneſs to poverty, the lime and dung were applied in quantities adequate to their melioration. The extent of their application will be detailed in the tables of expenditure.

The lime was laid upon the lands about the end of May, and immediately after its application they were ridged into drills of twenty-six inches for turnip: the dung was now laid on, and being ploughed down, and waste land, yet unimproved, and upon a similar pasture of one of the farms already mentioned. They begin to drop lamb about the first of April, and are then put into the graſs fields: these are never grazed after the first of January, so that when the ewes are put upon the graſs it is always a luxuriant pasture: it feeds upon an average four ewes and lambs per acre.

The lambs are sold fat in the months of June or July, and in general bring 12s. 6d. per head. The ewes are continued on the pasture until the end of October, when they are either sold for an increased price of five shillings each, or, as is more generally my practice, put upon turnip to be completely fattened. Upon the removal of the ewes, the graſs is eaten by young black cattle, and other stock upon the farm, until the end of December. They are generally benefited by this pasture; and the advantage it is of to them, fully compensates for the maintenance of the ewes throughout the winter. It appears therefore, from this statement, that 3l. 10s. is the profit upon each acre of graſs.

The mode of pasturing is followed on the succeeding year: but having found that new graſs is greatly preferable for feeding lambs, I plough up the graſs fields in the third year, and sow them with oats; which generally have been of such a quality as to produce six quarters per acre.

The oats are followed by a crop of wheat, if dung is plentiful, but more frequently by another crop of oats or one of peas. This pulse and the wheat have, upon an average, been produced in the quantity of twenty-nine bushels per acre; and in a field which was last year sown with this grain, and which contained several acres of moor land, the crop was most luxuriant upon this formerly barren heath.

This plan of cropping is varied according to circumstances; but my fixed mode of management is to take alternately a green and a white crop; and never, after breaking up the graſs, to sow more than two crops before the land is again prepared for turnip. When the turnips are sown, the land is again manured with the original quantity of dung, and is again laid down to pasture with a barley crop.

It appears, therefore, that every attention i paid to avoid heavy cropping; and it is not leſs evident that, by the prosecution of this plan of management, large additions of animal and vegetable matter will daily increase the richneſs and fertility of the soils.

Having now detailed the mode of improving the arable lands, and given an account of the produce arising from the melioration of the soils, I shall, before I state the expense of the improvement, concisely relate the steps which have been taken for increasing the value of the moſs land.

When I took the lease of my farm, this part of it was in the state of a wet and unproductive bog. It was only adequate to the support of a few crops and young neat beasts; and a great part of it was so perfectly boggy, that it was incapable of supporting the cattle, which grazed upon the firmer parts of it and upon an adjoining meadow.

The first step in the improvement of such land, was to carry off the ſuperabundant moiſture by draining. I had formerly recovered about thirty acres of land upon another of my farms, which was an entire marſh; and I did not deſpair of the ſucceſs of a ſimilar mode of improvement in the preſent inſtance. In attempting the melioration of the moſs land therefore, my firſt object was to run a principal drain, ſtretching from the inferior to the ſuperior part of it, where it is widely extended upon an adjoining eſtate; and to interſect it by ſmaller drains, terminating in the main conductor of the water. I accordingly had this drain completed in the ſecond year of my occupation of the eſtate: is was made ſix feet deep, twelve feet wide at the top, and eight at the bottom; and ſince its formation it had been repeatedly cleaned out. The interſecting drains have not been executed, and I do not apprehend that it will be neceſſary to fulfil this part of my intention.

The ſucceſs of the principal drain has anſwered my expectations; there has been always an abundant flow of water. The moſs is in various parts converted into meadow, and there is hardly any part of it except where pits have been dug for peat, that is not pretty firm and productive of ſupport to the cattle grazed on it. The adjoining meadow is likewiſe greatly meliorated; the graſses are much finer; and many parts of it are fit for producing corn.

The advantages attendant upon the fulfilment of a part of the plan of draining, are of the moſt promiſing nature. How far the completion of it would inſure the ſpeedy exſiccation of the moſs, I cannot pretend to determine. This object, however, ſeems more likely to be effected by another mode of draining, recently publiſhed to the world: I need hardly ſay, I mean that practiſed by Mr. Elkington.

I have lately ſeen Mr. Johnſton's perſpicuous account of this mode of draining, and have reſolved to practiſe it in preference to my original plan. I propoſe to bore auger holes in the bottom of the principal drain immediately; and thus allow a free exit to the waters which circulate below the level of its bottom. From the nature and ſituation of the ſtrata obſerved in an unfruitful ſearch after marl, I have no heſitation in pronouncing the ſucceſs of this intended operation: I have still leſs in expreſsing my hopes of converting this hitherto uſeleſs part of the estate into a valuable pasture-ground.

The moſs, besides a considerable quantity of meadow hay, already produces sufficient support for ten cows, and twenty young black cattle. These cattle are grazed upon the moſs through the day; and are fed with straw in a court-yard during the night. The yard is always well littered with straw; and as this is converted into dung, new layers of fresh straw are added, until such a quantity of excellent dung is formed, as is adequate to the manuring of sixty or seventy acres of turnip.

Such are the improvements I made upon my farm. The expense at which they have been executed will be shown by the following tables of expenditure.

I.

Average Expense of improving the best Soils denominated In-field, per acre.

	£.	s.	d.
First ploughing	0	5	0
Second ditto	0	5	0
Braking and harrowing	0	3	0
Third ploughing	0	5	0
Second harrowing	0	2	0
Collecting and burning the couch graſs and other weeds	0	3	0
Collecting and removing the land-stones *	0	7	0
One hundred and sixteen bushels of lime	4	7	0
Twenty cart-loads of dung, weighing 3 cwt.	2	0	0
First drilling for turnip	0	2	6
Second ditto	0	2	6
	£ 8	2	0

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[*] In this estimation of the expense of the labour bestowed upon the land, is comprehended that of the manual aſsistance sometimes requisite to the levelling of the surface; and the breaking of the clods by rolling. Neither of theſe operations could be made distinct heads of charge. The first was very partially required; and the rolling was only neceſsary in the most clayey soils, and there only after a wet season. It was very seldom needed by the soils comprehended under the second table; and those referred to in the third, never demanded its aſsistance to their perfect pulverization.

II.

Average Expense of improving that description of Land termed Out-field, the greater proportion of which was lying waste in a state of natural graſs, per acre.

	£	s.	d.
First ploughing	0	6	0
Second ditto	0	5	0
Braking and harrowing	0	3	0
Third ploughing	0	5	0
Braking and harrowing	0	2	0
Fourth ploughing	0	5	0
Third harrowing	0	2	0
Collecting and burning the couch graſs and other weeds	0	5	0
Collecting and removing the land-stones	0	14	0
One hundred and sixteen bushels of lime	4	7	0
Twenty cart-loads of dung, weighing 3 cwt	2	0	0
First drilling for turnip	0	2	6
Second ditto	0	2	6
£	8	19	0

III.

Average Expense of improving the Moor Land and Waste Out-field which had never been under cultivation, per acre.

	£.	s.	d.
First ploughing	0	7	6
Second ditto	0	6	0
Braking and harrowing	0	3	0
Carried over	0	16	6

	£.	s.	d.
Brought over	0	16	8
Third ploughing	0	5	6
Braking and harrowing	0	3	0
Fourth ploughing	0	5	0
Fifth ploughing	0	5	0
Third harrowing	0	2	0
Sixth ploughing	0	5	0
Fourth harrowing	0	2	0
Collecting and burning the roots of the ling, &c.	0	3	0
Collecting and removing the land-stones	1	2	0
One hundred and thirty-five bushels of lime	5	1	6
Twenty-five cart-loads of dung, weighing 375 cwt.	2	10	0
First drilling for turnip	0	2	6
Second ditto	0	2	6
	£ 11	5	8

These tables show, as correctly as it was poſsible to do at the time of their construction, the expense attendant upon the melioration of each acre of the three descriptions of soils which have been the subject of improvement. In stating the different heads of expenditure however, it was impoſsible to affix to each acre of land a certain proportion of under-draining, as the neceſsity of this operation was not only partial, but infinitely varied in different situations. This part of the expense of improvement, therefore, will be noticed in the general table of expenditure.

The quantity of soils which are already improved, amounts to four hundred and sixty-eight acres: the portion of land which comes under each table of expenditure is not easily ascertained, as improvement has wrought a wonderful similarity in the appearance of the surface of the grounds. I have, however, examined all the improved fields with great care and attention; and have had the different quantities of each kind of soil measured with as great a degree of precision as it was poſsible to command. To extreme accuracy I cannot pretend; but I am certain, if there is any error, that it is of the most trifling nature, and wholly undeserving of notice.

Having premised thus much, we are prepared to enter upon the general statement of the expense of the improvements which have been executed upon my farm. In giving this statement, however, it is neceſsary to observe that there was no poſsibility of noticing every expense connected with the plan of improvement. In the execution of this plan various small sums were required by different objects; and where the improvements were executed on so considerable a scale, it may easily be imagined that the contingent expenses must have been considerable. There is, however, but little reason for regretting the deficiency of this part of the general table of expenditure, as an account of contingencies, besides adding to the amount of the sum expended, would be productive of very little useful information.

General Table of Money laid out upon the Improvements already executed on my Farm.

	£.	s.	d.
Inclosing and subdividing the lands	564	0	0
Farmers proportion of the labour bestowed upon the hedges	60	0	0
Improving 274 acres of land comprehended under the first table of expenditure	2229	8	0
Improving 121 acres of land comprehended under the second table of expenditure, nearly 50 acres of which were lying waste, in a state of natural graſs	1082	19	0
Carried over	£ 3936	7	0

	£.	s.	d.
Brought over	3936	7	0
Improving 73 acres of land comprehended under the third table of expenditure, 42 acres of which were moor land.....	823	1	6
Manuring a part of the fields around the mansion-house before they were ſub-let...	55	0	0
Draining the wet places dispersed throughout the lands which have been improved............................	30	0	0
Draining the moſs............................	110	0	0
Repairing one of the farm-houſes, and erecting and repairing cottages for the accommodation of labourers employed in carrying on the improvements..	250	0	0
£	5204	8	6

Such is the moderate estimation of the sum I have expended in executing the improvement of waste and unproductive land. I shall not indulge myself in any observations on its magnitude, convinced that silence is here equally proper and impreſsive.

The expenditure has indeed been to a great extent; but it is also true that it has been productive of the most lucrative returns. The soils which were in the impoverished condition formerly described, are greatly enriched; various parts of my farm are worth fifty shillings an acre; and all the improved lands, upon an average, would be cheaply rented at thirty shillings per acre. I indeed sub-let a field of twenty-five acres to a small farmer, a twelvemonth ago, for forty-five shillings an acre, which before its improvement was not, upon an average, worth more than seven shillings; he pays his rent by labour in carrying lime to the parts of the estate yet unimproved.

The improvements have been too encouraging in their effects to leave any hesitation about the propriety of completing them; I go on to fulfil the obligations of my lease. All the inclosures on the south of the plantation, stretching along the high ground, are improved, except three; and these I propose to plough up immediately: they consist of waste and moor land, and of out-field lying waste in a state of natural graſs.

In order, likewise, to make the remaining part of the estate fit for the proceſs of improvement, the subdivision of the grounds upon the north side of the plantation just mentioned, will be completed in the course of this winter. The grounds, in this part of the estate, are of the same nature as those which compose the unimproved fields on the south side. The improvement of all the soils, which have been permitted to lie in the unproductive state they were in at the period of my entry into the farm, will not be completed at a leſs expense than that of the same descriptions of land referred to in the second and third tables of expenditure.

It is impoſſible to fix the period when the improvement of the whole land will be completed: circumstances may hasten or retard my operations. I calculate, however, upon an end to my expenses and improvements in six or seven years: I shall then enjoy the fruits of much labour and exertion. The difficulties engendered by industry will give place to ease and quiet; and I shall have the further reward of enjoying the consciouſneſs of having proved no unuseful member of society; in having increased the fertility of a portion of the earth; in having supported a more numerous population, and in having augmented the value of an estate, in no long period of years, from three hundred and twelve, to more than twelve hundred pounds per ann.

ESSAY XII.

On Soda, or Mineral Alkali, for Washing, &c.

IT is generally allowed, when soap is used alone in washing, that it takes sixteen ounces to wash fourteen pounds of clothes.—Price of the soap, 9d. or 9¼d.

The same weight of clothes may be washed by

Six ounces of soap, price -	3¼d.
Four ounces of soda, retail price - - -	1½
	4¾

Economy in the materials employed is not the only benefit; clothes are sooner and better washed with soda and soap, than with soap alone.

Pearl ashes, and ash balls, made of the ashes of burnt vegetables, are in many parts of

England employed to soften hard water, and render it fit for washing; but pearl ashes are seldom used in the manner here recommended, on account of the injury which this alkali (from being in part caustic) occasions to the hands. This is not the case with the crystals of soda; it is a mild alkali, completely saturated with carbonic acid, or fixable air.

The use of soda in washing is now very general in the north of England, and in some parts of Scotland: no complaints are there made of its injuring the hands, because it is used judiciously.

DIRECTIONS

For using Soda or Mineral Alkali in Washing.

When the washing is performing by hand, four ounces of soda and six ounces of soap, are sufficient for fourteen pounds of clothes; when washing machines are made use of, eight ounces of soda, and four ounces of soap, will answer for the same quantity of clothes.

The soda to be diſsolved in water, in the proportion of half a pound to the gallon, and the solution added to the washing liquor, as found neceſsary.

When soda is made use of, hard water answers every purpose for washing, as in a few minutes it makes the hardest water perfectly soft.

On trial it will be found, that the use of soda in washing will be a saving of from one-third to one-half of the expense of washing, when soap is used alone.

When hard water is used, the crystals of soda may be put into the boiler, or copper, employed to heat the water, in the proportion requisite to soften it; this will be found, weight for weight, to be nearly the same as pearl ashes. Nothing but experience can teach the proportion of soda that is requisite, as some waters are much harder than others. Alkaline salts render hard water cloudy; the water should be allowed to become clear, and the earthy matter subside, before it is used.

When soft water is used in washing, leſs of the salts are requisite; they may either be diſsolved in water, and the solution added in small quantities at a time, to the water employed in washing; or the salts may be added in substance to the water, in which it will soon diſsolve, if the water is warm. The rule in both cases is, to add no more soda than will make the water gently unctuous, or slippy to the feel.

When the suds grow harsh, and lose the bell or lather, they produce no more effect in washing; but this is again to be promoted by the addition of a little more soda, or its solution, even without the use of more soap.

When too much soda has been employed, the lather or froth will work over the top of the washing tub, and prevent the washerwomen from seeing the clothes which they wash.

In short, a little practice is requisite to attain the judicious and proper use of soda.

The beneficial effects of soda in washing are still more fully experienced in washing woollens and worsteds, than in washing linens and cottons. Worsted stockings, flannels, and fleecy hosiery, are usually washed with warm water, in which a proportion of soap had been diſsolved, and a proper lather made—Dipping the articles to be washed into the lather, or soapy solution, drawing them through the hands, without rubbing them, wringing them out of the first or second lather, without rincing them in hot, and still leſs in cold water.

By this method of washing, a proportion of soap adheres to the particles of the wool. This prevents the flannel, or fleecy hosiery, when worn next the skin, from so readily taking up the perspirable matter of the body; consequently from producing the full medical effects attendant on the use of properly cleaned flannel, &c. &c. But as soda in washing saves ten ounces of soap out of every sixteen, therefore a proportionably leſs quantity of soap will adhere to the wool. Even this quantity may be still diminished, by paſsing the goods a second or third time through a water in which a greater proportion of soda, and a leſs proportion of soap, had been diſsolved.

The extreme variableneſs of the climate of Britain, with the advice of many eminent physicians, has induced a considerable proportion of the inhabitants of this country to wear flannel and fleecy hosiery next the skin. The use of flannel, &c. would be more general, could they be more effectually prevented from shrinking in washing. Soap and rubbing should be employed as little as poſsible. Rubbing felts puts together the particles of the wool, shortens the nap, or surface, contracts and shrinks the goods, and injures their softneſs.—There is another reasons why flannels, &c. are better washed by soda and soap, than by soap alone, namely, that soda is a more complete solvent of the perspirable matter of the skin than soap.

Persons whose perspiration, whether sensible or insensible, is increased, as of course it must be, by wearing flannel, &c. next the skin, should not only frequently change their flannels, but should likewise once or twice a week, or oftener, paſs a towel over their bodies made wet in a solution of soda and soap, to deterge the thickened perspirable matter, and open the pores. Soda should, with that view, be used at all private and public baths; for, exclusive of the grand object of health, it may with truth be said, " that by the body's purity, the mind receives a secret sympathetic aid."

Soda should always be used in the water employed to wash feet. The washing the feet frequently is very salutary, extremely conducive to the health of the individual, as well as to the comfort or pleasurable sensations of others, as it effectually removes all smell, and is on that account recommended in a particular manner to those individuals who wear black silk, or black worsted stockings, especially in warm weather.

A small quantity of a solution of soda immediately and effectually diſsolves the tartareous incrustations on bottles and casks in which wine had been kept.

A weak solution of soda cleans unblacked boot-tops, saddles, saddle-flaps, and bridles, without injuring the original colour of the leather.

A solution of it is an excellent application for cleansing the throat, mouth, and gums, from slimy matter, or animal gluten.

It renders the teeth remarkably white, by diſsolving the fur or incrustration on their surface, without, in the smallest degree, injuring the teeth, as all acids do.

It is one of the best applications as a gargle, for most ulcerated sore throats.

A small quantity of a solution of soda, taken internally now and then, after washing the mouth with it, immediately and effectually removes all bad smell from the breath.

It is very much to be preferred to magnesia, for correcting acidities in the stomach and viscera. It is one of the most effectual preventives and remedies for the gout, gravel, stone in the bladder, obstructions in the kidneys, gall-bladder, and biliary ducts; it promises fairer than any article known, to diſsolve and prevent the increase of oſsified matter in the human body, and by so doing prolongs life. This oſsified matter being not only the cause of many diseases, but the proximate cause in shortening the life of man; a superabundance of oſsified matter (consisting of the phosphats of ammoniac and lime) prevents the motion of the joints, occasions, in a great measure, the rigidity and stiffneſs attendant on age, and furs, and at last shuts up, the paſsages through which the fluids of the body should circulate.

Soda, to the extent of a drachm, diſsolved in a pint of water, should, from time to time, be taken internally by persons who are given to the use, or over use, of strong sizey malt liquors, particularly after a debauch; the stomach and intestines are then surcharged with a very indigestible liquor, too thick to be discharged by urine, or thrown off by perspiration; by remaining on the stomach it becomes extremely acid, and either occasions violent retchings or cramps. Both are immediately cured by soda, which, combining with the acid, forms a mild purgative, and thereby carries away that, which, were it to remain in the body, would materially prove injurious to health.

Soda, mixed with cream of tartar, in the proportion of fourteen parts of soda to twelve parts of cream of tartar, forms one of the mildest and best of all pugatives, namely, the salt of Seignette, or Rochelle salt; as a purgative, it is greatly to be preferred to Glauber salt.

A solution of soda should be used from time to time to remove the grease which adheres to kitchen utensils. Grease, when it is allowed to remain on copper, or copper veſsels improperly tinned, forms a rust and strong poison, in the same manner as acids do;—too much attention cannot be had to keep such veſsels clean. Even tin veſsels, which are the safest to use of any, should, from time to time, be cleaned with soda, to prevent them from rusting. The tins should be well wiped, and dried before the fire, before they are set by.

Milk veſsels, when the utmost attention is not had to keep them clean, are apt to acquire an acid, and even to a degree, a putrid smell; even the utmost cleanlineſs in the usual way, will scarcely prevent such effects, during the great heats of summer, or after a thunder-storm. A small proportion of soda renders milk veſsels perfectly sweet, and neutralizes and removes the acid ferment imbibed by the wood, which otherwise would affect milk put into such veſsels.

Persons who keep horses, especially those employed in posting, hunting, and horse-racing, (such horses being most subject to profuse perspiration,) should, from time to time, paſs a sponge, dipped in a weak solution of soda, over their bodies, to decompose and deterge the perspirable matter, which, when not properly removed, dries on their bodies in the state of a salt, and frequently in a saline incrustation, irritating the skin of the animal, producing fever, laſsitude, and stiffneſs.

ESSAY XIII.

On Farm Buildings in general.

THE construction and arrangement, together with the situation of farm buildings, are objects of so much importance to the practical farmer, that they merit the most particular attention. On a judicious combination of these, the facility of carrying on his various operations, in a great measure, depends. Yet how few are the examples we meet with of farm offices either commodiously planned, or judiciously situated.

Whether we view this subject as relating to the landlord, to the tenant, or indeed to the public at large, it appears highly interesting.

To the landlord it is a matter of considerable moment, a part of his rents very often depending upon it; for it is natural to suppose that a tenant, especially on a long lease, would give more for a farm if the house and offices were commodious, than if they are so miserably deficient, as most farm offices are. He would even be the more readily induced to take a farm on that very account, and thus the landlord may often lose a good tenant, merely by not having proper accommodation for him.

I have heard farmers declare, that they would willingly agree to pay 5 per cent, or more, on the expenses laid out on commodious buildings, over and above the rent of the farm, rather than occupy for nothing those they at present poſseſs; and that they would besides undertake to be at the expense of every ordinary repair during the continuance of their lease. How then can a landlord lay out a few hundred pounds to better purpose than to accommodate his tenants, if he gets not only 5 per cent. on the money thus l out, but (provided his buildings are very co plete) perhaps as much additional rent as w amount to 5 per cent. more.

I am well convinced that the great expe of erecting new farm buildings in the us way, is a very material obstacle to alteri the present form; for there are few landlo who would choose to lay out five or six tim the rent of a farm in new accommodati for that farm, if by propping and patchi he can, at a small expense, make the buildings answer.

When we hear of 500l. being expended building a barn on a farm of about 200l. re as is the case in some parts of England, an thousand pounds laid out on a farm house is no wonder that landlords are cautious engaging in such buildings; and it cannot supposed that tenants would be mad enou to do so. Hence, perhaps, is the princi reason why the generality of farm houses a offices are in so ruinous a condition. I when farmers can be persuaded that su enormous barns are unneceſsary, that th corn can be kept much more secure, and leſs liable to injury, in a well aired rick-yard; and that if they have just room enough in their buildings for all the common purposes of the farm, no more is requisite: also, that a neat, small, commodious dwelling-house, is fully more comfortable than a large dismal one; then we shall find that landlords will more readily agree to accommodate their tenants, and that instead of those gloomy, preposterous, ruinous buildings, now a disgrace to almost every part of the kingdom, we shall behold neatneſs and uniformity, combined with every neceſsary accommodation; which will afford not only pleasure and comfort to the occupiers, but a beauty and an ornament to the country at large.

That this may be accomplished at a very moderate expense, I hope to be able to prove in the sequel.

So far as any general rule can be given upon this subject, and allowing for circumstances and the variation of prices, I am fully persuaded by the observations I have made in different parts of the kingdom, that in general one year's rent of the farm, if not under 70l.

(or at most two rents) is amply sufficient for building every accommodation neceſsary upon that farm, exclusive of the dwelling-house: and that one year's rent is enough to build a dwelling-house, on all farms not exceeding 400l. a year (in many situations leſs may do). And lastly, that 500l. are sufficient for a dwelling house, and 1000l. for offices on a farm of any extent*.

To a tenant, the construction and arrangement of his farm buildings, is a matter perhaps of more importance than even to a landlord.

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* In building new farm houses and offices, a great saving of expense will accrue by making use of all the serviceable materials in the old buildings, where such buildings are; and it will astonish many (provided they are fairly dealt with) who have been accustomed to those large, unneceſsary, and expensive buildings commonly used, at how small an expense, comparatively speaking, a new set of offices, or house may be built, having the advantages of such materials near the spot. Workmen, in general, are much averse to using old materials, especially carpenters, who, rather than run the risk of touching a rusty nail, with a hatchet or a saw, will put their employer to the expense of some hundreds of such tools, by condemning the old, and advising him to purchase new timber.

After all his toils and labours, and the many anxious and sleepleſs hours he has paſsed before his crop has come to maturity, if his offices are insufficient, or improperly constructed, he still runs the risk of many inconveniences, and even real loſs. The security of his grain, the labour and the value of his horses and other cattle, the safety and duration of his implements, are all dependent on the perfection or imperfection of his offices.

By arranging them judiciously (a matter very little attended to) a great deal more labour may be obtained from his servants, and every operation on the farm will be carried on with more facility and dispatch. For if a barn is set down here, a stable there, a cow-house, or feeding house, in another place, all without rule or order, and as if chance had set them down, much unneceſsary labour will be occasioned, and a great deal of time lost in carrying provender to the cattle, and in keeping them so clean and dry as is neceſsary towards their health and preservation.

Farm buildings should be proportioned and constructed according to the size and produce of the farm; which, in settling their dimensions and arrangement, must be particularly taken into consideration. If, for example, the farm is adapted entirely to grazing, very few buildings will be neceſsary, except some sheds, and these will be in use chiefly during the winter season, temporary ones being often erected in the fields for the summer. On farms where cattle are housed only in winter, or in such farms where more buildings are used in winter than in summer, a great expense in roofing may be saved in cattle sheds, by erecting walls only, or having pillars or posts placed and framed in such a manner as to support hay-ricks, peas, or any other sort of ricks that are not intended to be taken down till the spring or summer. This will not only answer the purpose of an excellent warm roof, but will be a very good situation for building such ricks. If, however, the farm is entirely for grazing, as before supposed, there may not be a sufficiency of ricks, unleſs of the fodder for the cattle, to make such temporary roofs. In that case the sheds must of course have permanent ones, which may be of the cheapest construction. Or if there should be a sufficient number of boards about the farm, as is sometimes the case, they may be laid loosely on, to serve as a roof to the sheds, till wanted for other purposes.

A dairy farm will require a different sort of accommodation, being in general composed partly of the grazing and partly of the arable kind. The cow-houses must be proportioned to the number of cows usually kept, with every other accommodation for carrying on the dairy buſineſs, whether as a cheese or butter farm. Small stables and a small barn are sufficient for such a farm. But in an arable or corn farm, which generally partakes of both the other sorts, the buildings must be more numerous, and suited in some respect to all these different purposes. The stables, in proportion to the number of horses or cattle requisite for labouring the farm. The cow-houses and feeding-houses, according to the number of cows generally kept, and cattle fed. The barn and granary, according to the extent of arable land; together with all the other usual accommodations for breeding young horses or cattle, for hogs, poultry, &c. all which must be particularly considered of while planning the farm offices.

Since the invention of thrashing mills, a most material alteration may be made in the construction of farm buildings, particularly in barns. The tedious and laborious operation of thrashing with the flail, made it neceſsary to have the barn large enough to hold a great quantity of corn in the straw, or at least to contain a whole stack at once; and besides, to have it so lofty as to give sufficient height for raising the flail. This is by no means neceſsary where there is a thrashing mill; for as the mill, if properly constructed, will thrash the corn as fast as taken in, it is unneceſsary to throw in the whole stack at once; and what remains of it in the rick-yard, if any, may be covered with a tarpawling, or painted canvas for that purpose; a thing that every farmer ought to have, being of eſsential use either in case of a sudden shower in harves when building a stack or hay-rick, or o leaving one unfinished at night, or any oth time.

A thrashing mill not requiring so lofty barn as a flail, a very convenient granary store-room may be obtained above the mil which, in the common way, could not hav been had. In short the advantages of thrashing mill are so numerous, that no farm producing 1000 or 1200 bushels of grain annually, should be without one.

When the plans of any farm buildings are finally determined on, there are many preliminary considerations neceſsary to be attended to, previous to the commencement of the work. The situation with respect to the quality of the air, the water, materials for building, acceſs and exposure, the soil for laying the foundations upon, the best method of conducting the drains, together with the expense of completing the whole.

ESSAY XIV.

On Farm Houses.

A FARM HOUSE ought not only to contain every conveniency for a family, but should have a degree of neatneſs and uniformity, which, if properly managed, will cost no more than a dull irregular building. Columella says, that " a farm house should be somewhat elegant, to give pleasure to its poſseſsors, and to allure the wife to take delight in it. It should be built on the most healthy spot of the farm, in a temperate air, such as the middle of a hill commonly enjoys, where it is neither stifling in the summer, nor exposed to the rage of winds and storms in the winter."

The size of a farm house should be regulated by the size of the farm, although not so strictly so as the other buildings; a parlour and kitchen, with dairy, closets, and other conveniences, below stairs, and the upper story divided into bed chambers, are sufficient accommodation for any farmer's family. These may be contracted or enlarged according to circumstances, or to the inclination of the proprietor: but it is better to give a little more room than neceſsary, than not to give enough.

None of the buildings about a farm admit a greater latitude of construction than the farm house; for sometimes a very small house may do for a very large farm; at other times it would require a pretty large house on a small farm, according to the size of the farmer's family, and, perhaps, to the situation in life he has been accustomed to; for there are many very respectable and worthy farmers, whose manners and conversation entitle them to the best accommodation; and it sometimes happens that a landlord will consider this, and build a house for the farmer, instead of the farm

There is something so pleasing in the appearance of neatneſs and cleanlineſs about a dwelling house, that even a stranger transiently paſsing by, cannot help being prepoſseſsed with a favourable opinion of those within. He paſses along with the idea fixed in his mind of prosperity and happineſs presiding within those walls. How different the sensation felt on viewing a contrary scene:— a house dismal and dirty, the doors and walls surrounded and bespattered with filth of all denominations, and fragments of broken dishes and dirty dairy utensils scattered in all directions: a scene which must impreſs on the mind the idea of misery and mismanagement, and a contempt for those slatterns who can suffer such beastlineſs; for in such cases it is generally the female part of the family who have the merit or demerit of domestic appearances. And how easy a matter it is to constitute the difference: a little care and attention is the whole secret.

It adds greatly to the beauty and neatneſs of a dwelling house, to have a little plot of garden ground or shrubbery before it: this not only contributes to keep every thing neat and clean in front, but is often easier managed than a garden behind. After feeling the pleasure and satisfaction of keeping this plot in good order, every weed that appears visible from the windows, will be considered as a nuisance, and pulled up accordingly. So great an antipathy to weeds may thus be raised in the farmer's breast, that his efforts for their destruction may even be extended to the fields;

and by these simple means a slovenly farmer may be so completely reformed, as not to suffer a weed to be seen on his farm.

Large windows add greatly to the cheerfulneſs of a farm house. The sashes being placed as near the outside of the wall as possible. The reverse of this is a glaring deformity in most houses in the northern parts of the kingdom. There the windows are so small, and the sashes placed so deep in the walls, that it gives the most disagreeable gloomineſs to the whole building. This is said to be done with an idea of preserving the sashes from the weather—a most egregious mistake. The sashes are perhaps more liable to injury by being deep in the walls, than by being placed near the outside, for they receive full as much wet, and are not so soon dried,

It is a common practice, and with many a general rule, to build the farm house adjoining to the offices. Where the situation will not admit of a better arrangement, or in a small farm, to save a few roods of building, this may be done; but in general it is better to build the dwelling house, and any other buildings with chimneys in them, a little way detached from the farm offices, not only on account of the danger arising from fire, but of the disagreeableneſs (perhaps unwholesomeneſs,) of living in a dunghill, or in the midst of cattle and swine.

If a farm house, for the sake of uniformity, is to be built adjoining the farm yard, there should be a considerable length of wall at each end of it, to unite it to the offices. But it is certainly better to make the house a little distance from the wall of the yard, and whether that distance is ten feet or fifty feet, there can be little or no difference with respect to convenience. At the same time it is by no means advisable that the farm house should much exceed fifty or sixty yards from the offices, as there might unquestionably some inconvenience arise if beyond that distance.

In plans of farm houses, four things should be particularly attended to : simplicity, uniformity, convenience, and cheapneſs. In delineating such buildings, therefore, there is not that latitude given for a display of those architectural ornaments, which, in a higher sphere of buildings, are so pleasing to the eye, and so truly beautiful when disposed by the hand of a skilful architect. Such ornaments are unneceſsary in farm buildings, and therefore entirely omitted. At the same time a strict attention to uniformity should be particularly observed; and although the windows be in general made something wider in proportion to their height, than is permitted by the rules of architecture, in order to answer the purpose of giving as much light as poſsible (the chief use of windows,) no very great or offensive deviations should be made from those rules, even in that case.

The accommodations should be as convenient as poſsible, in the family way; and by making the ground-floors at least 16 inches, or two steps, above the level of the ground, and taking proper care to lay those floors, a great deal of that dampneſs (and consequently unwholesomeneſs) so often complained of will be prevented.

Many people prefer gable ends. For my own part, I am of opinion that hip-roofs, and the vents within the building, are greatly preferable. The hip-roof requires no more materials; and the gable ends not only occasion more expense of building, but an unneceſsary addition of weight upon the end walls. Vents built withinside the house are leſs liable to smoke than when in an outside wall; besides, they contribute greatly to keep the house warm, for they act as flues, and diffuse their heat, in some degree, all over the building.

Let the principal walls be of the thickneſs of two feet: that being considered as the best thickneſs for rough stone walls. Where the stones are good, and of a proper form for building, or where bricks are used, the walls may, no doubt, be thinner: but when too thin, the heat of the sun in summer, and the coldneſs of the external air in winter, have so disagreeable an effect, by penetrating through, that it is best to err on the safe side, and to make them of a good thickneſs. This is one of the greatest inconveniences of brick buildings; for in general brick walls are so thin, that these effects are most sensibly felt both in summer and winter.

By making the different apartments and other divisions and conveniences no larger than neceſsary, the least poſsible expense will be incurred. The dimensions of these should be proportioned according to the sum intended to be laid out*.

Some people will pretend to make an estimate, without even inquiring into those circumstances which must regulate the expense, knowing that when the sum they mention is expended, their employer will not stop the building on that account. It is best to be cautious in dealing with such people, unleſs they will contract for the sum estimated.

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* Very frequently a good plan is thrown aside, merely on account of the expense of putting it in execution; whereas it should be considered, that by contracting the rooms, and the building in general, the same plan might be executed accordingly, at whatever expense may be determined on. Estimates of buildings, in a general view, are really of leſs importance than most people imagine; there being hardly two counties in the kingdom where the same plan can be executed at the same expense. Even in the same county and in the same parish, the expense will often vary considerably, according to circumstances. The distance from materials, the quality and price of those materials, the goodneſs or badneſs of the roads, the nature of the soil to be built on, and consequently the expense of the foundations, the price of labour, the season of the year, and even the state of the weather, all tend to make a difference in the expense of building. It is therefore hardly poſsible to make a correct estimate, unleſs the spot intended for erecting the building is known and examined; and an incorrect estimate is much better to be omitted.

In some parts of the country a small hou may be completed for about 70 or 80 pound In other parts it may cost 150l. or more consequently it would tend only to mislea by stating either the one or the other as a estimate of such a building. Yet to commence a building, without knowing previously the expense it will cost, should at all events be avoided, as being almost a certain opening for imposition. The best way, therefore, to ascertain this, is to choose a plan ; if the proposed building is not of that extent or importance to require the aid of an architect, employ any person conversant in those matters, whose fidelity can be relied on, to examine the ground, and to consult with different tradesmen concerning the expense at which they would undertake to execute their respective parts : a pretty correct estimate may thus be obtained. Or the plan may be laid before different intelligent tradesmen, and their estimates required ; and afterwards particularly examined into, not only as to the charges made, but the manner of executing the work ; for it is not always the lowest estimate that is to be preferred. If in either case the sum should amount to more than is proposed to be laid out, the dimensions of the plan, and the manner of finishing some of the parts, may be altered, till it is found that it may be executed for about the sum proposed.

ESSAY XV.

On the Rot in Sheep.

VARIOUS are the opinions of authors on the subject of the rot in sheep, some supposing it to be occasioned by the sheep feeding on certain graſses, natural to moist and marshy grounds; others confidently aſsert, that the disease is occasioned by the introduction of certain animals, commonly called flukes, from their resemblance in shape to a flounder, or rather a soal. The claſsical name of this animal is Fasciola Hepatica, Linn. Its places of residence are, the cystic duct, the gall bladder, the common biliary duct, and the biliary ducts that run through the body of the liver. In all these places I have found them. Salt is by some shepherds recommended for the destruction of these animals. Others speak favourably of oil of turpentine; but when we anatomically consider the places where they take up their abode, there seems to be but slender hopes of finding an adequate remedy. Perhaps something may be expected from mercury. Bitters are noxious to worms, but these cannot affect the fluke, as it lives in a fluid, the bitterest of all the animal secretions. It appears to me that the sheep take in the ova, or rather the young flukes, with their food, and these after paſsing the four different stomachs, are carried down to the duodenum. Being so far advanced, the flukes, by a kind of instinct, paſs to the places of their future residence, entering the common biliary duct where it opens into the duodenum. There is no other way that they can find an entrance into the liver. In opposition to this opinion, Dr. Harrison, an ingenious Physician at Horncastle, contends, that the rot is occasioned wholly by marsh miasmata, bringing on a putrid fever, and upon this subject, he reasons very ingeniously in the 235th number of Mr. Young's Annals of Agriculture; but I confeſs I am not convinced by his arguments.

Indeed, most of his arguments are as much against him as for him. He observes, that when the graſs is permitted to grow tall upon rotting ground, or when the sheep graze in water up to their knees, that they do not, in either case, rot, till the long graſs is eat up, or the water has been greatly diminished. Now, as the fluke is supposed to lie close to the ground, it follows that it cannot be taken into the stomach of the sheep till they have fairly eaten down to the bottom of the graſs, at which period the rot is supposed to commence. Those who have attended to the close biting of sheep, will readily admit, that at this time, especially when the land is overstocked, there is the greatest danger. Dr. Harrison justly observes, " when a marshy piece of ground is imperfectly drained, that it will certainly occasion the rot, but when completely drained, that we need not fear such unpleasant consequences," but he attributes this to the removal of the marsh miasmata. On the contrary, I conceive that the removal of the water occasions the total extermination of the flukes; for water in a state of putrescency, seems to be their natale solum. I have no hesitation in giving it as my decided opinion, that the rot in sheep is an animal-that disease, and that it cannot be explain upon any other principle; for, as far as I kno the rot has never been observed without concomitant flukes, which are more or leſs merous in proportion to the malignancy of th disease.

ESSAY XVI.

On Barns.

IN most parts of England the size of barns, consequently the great expense laid out upon them, appears very far to exceed what is neceſsary for such buildings. This extent of building is by many thought requisite for the purpose of storing the crop in the straw; a practice so prevalent in many places, that it may not be improper here to examine into the motives for doing so.

The principal reasons why many farmers are so partial to housing their corn, are said to be these:

First, because it is built at leſs expense in the house than in the rick yard. Secondl because it is better secured, and saves the expense of thatching and of thatch. And thirdly, because it is always at hand to be thrashed.

The first of these reasons appears to be quite imaginary; for surely the care neceſsary to be taken to build in the barn so compact as is generally done, in order to keep out vermin, as is supposed, and to make it hold the greater quantity, must be attended with full as much expense as building in the rick-yard, perhaps more; for in a large barn, the distance to throw the sheaves, and the number of hands requisite to carry them to their proper places for packing close, will be attended with more expense and labour, and more loſs of time, than building in the rick-yard. The second reason seems also to have little weight; for although neatneſs in every thing is much to be commended, there is certainly no neceſsity for consuming either so much time or so much thatch in covering stacks as is done in many places. If they are thatched sufficient to keep out rain, and secured properly to resist a blast, it is all that is requisite; but to bestow as much labour and expense on covering a stack which will probably stand but a few weeks, as in covering a permanent building, is surely most completely absurd, and totally inconsistent with that despatch which ought to be observed in all the operations of farming, particularly in the harvest time, when a farmer should always be in a hurry; for it ought to be a general rule with every farmer, especially at that time, never to lose a moment, but to make the most of the present hour, and on no account to delay or trust any thing to the next; but to consider, however fair the prospect may be, that the next hour, or next day, may be so changed as to put it out of his power to proceed with his operations. On this principle, which is founded on reason and prudence, corn should be put in the stack whenever it is ready for it, which it will certainly be several days before it can be ready to put in a large barn.

No stack should be above 10 or 12 feet in diameter, but most barns are from 20 to 24 feet wide. Is it to be wondered at then, that corn piled to such a thickneſs contracts a mouldineſs? It would be much more extraordinary if it did not, for it is indisputably evident, the nearer the external air is admitted to the heart or middle of the stack or mow, the leſs chance there is of its being injured, and the sooner it may be stacked. That even farmers themselves are sensible the admiſsion of air is neceſsary, is clear from the pains they take to have air-holes in their barns: why then will they act so contrary to their own conviction, and to common sense, as to pile up their corn within a building, when it can be so much better aired in the rick-yard; and even to pack it so close that no air can poſſibly be admitted, when at the same time they have numbers of air-holes for the very purpose of admitting it.

As gaining time to get a crop in sa[illegible] so precious an object to the farmer when his corn is cut down, it might perhaps be an easy and a safe method to build it in oblong ricks, rounded at the ends, which might be done very soon after it is reaped. The width of these ricks to be according to the state of the corn, that is, from five or six feet, to about eight feet, but not more; or perhaps as wide as nearly the length of two sheaves, so as to give them a sufficient hold of each other to bind properly. Their length may be of any extent judged most convenient. The advantages of this mode are, 1st, That the corn may be much sooner put together in safety than in the common way. 2d, That staddles for building these ricks on will be very easily and cheaply erected. 3d, That the expense of thatching will be leſs than in round stacks of the same contents. 4th, That they may be finished and thatched at one end, before the other is completed. 5th, That when wanted to be thrashed, by beginning at one end no more need be taken down than requisite or convenient to thrash at that time, and that end may be secured from the weather by tarpawlings, or otherwise, or by a sliding cover, on the same principle as his Majesty's ingenious moveable barn, at Windsor. Stacks built in this manner, or even in the common way, are therefore most undoubtedly preferable to housing the corn, and may even be built at much leſs expense than in a barn.

The expense of thatch is but trifling, for after it comes off the stack it will answer the purpose of litter for work-horses or cattle, equally well as it did before.

If a farmer has not straw sufficient to thatch his stacks, he may, with a thrashing mill, get as much in half an hour, or an hour, as he has occasion for.

Here is another great advantage of a thrashing mill, for, if properly constructed, although it may bruise the straw a little, it does not cut it so as to prevent its answering the purpose of covering stacks; for which purpose oat or barley straw, drawn even, and properly laid on, will do sufficiently well, as can be testified by the experience of many.

The third reason for housing corn, is so much overbalanced by the advantages pointed out in the objections to the other two, that it is unnecefsary to enlarge upon it; besides, as no farmer who studies his own interest, and the great importance of despatch in all his operations, will ever now think of using a flail if he can get a thrashing mill, he must be satisfied that no such reason can, in that case, have the smallest weight.

The great and principal object with a farmer, when his crop is cut down, besides securing it from vermin, is to preserve it in the completest manner from wet or dampnefs, or becoming mouldy. To attain this, after being properly secured from external moisture, it must be acknowledged that a free admiſsion of air is absolutely neceſsary*.

On a tour lately made through great part of England, I had many opportunities of examining the condition of corn and straw piled up in large barns, and I observed but very few instances where the mow had not contracted a considerable degree of mouldineſs; besides, they were so infested with rats and mice that the damage done by those vermin must have been immense, although some farmers seemed to consider it as a mere matter of course, and gave themselves no trouble about preventing it[*].

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* It is observed that all sorts of corn in the straw, soon after it is built in a stack or mow, generally sweats a little, or what in some places is called, comes again, however dry it may have been put up. This will happen in a greater or leſser degree, according to the state of the atmosphere at the time of its being put together. If this is the case, which every experienced farmer must know, it is evident that without a free admiſsion of air it is hardly poſsible, after this sweating, to restore the mow to its former dryneſs, or to prevent it contracting a mouldineſs that must greatly injure both the corn and the straw.

Security from vermin, and a free ventilation, being so eſsentially requisite for the preservation of corn in the straw, and as these cannot be obtained if lodged in a barn so effectually as by building upon proper staddles in a well aired rick-yard, it is hoped that farmers will adopt this method more generally, which would not only be the means of increasing their profits, but by abolishing those large expenſive barns, would leſsen the expenſe of farm buildings ſo much, that a landlord would not conſider it ſo very ſerious a matter to give his tenants a new and commodious ſet of offices when neceſsary. Where the flail is uſed, the greateſt pains ſhould be taken on the conſtruction of the barn-floor; in making which there are various ways practiſed for rendering them as firm and as dry as poſsible.

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[*] It is wonderful that husbandmen should be so blind to their own interest as to suffer the depredations of those mischievous vermin, without using every effort to prevent it. They loudly complain of the hardships of the Clergyman's dues, but allow those useleſs and destructive depredators to prey upon their property, unmolested and uncomplained of. In every county, and every parish, there ought to be aſsociations for the purpose of destroying and annihilating those vermin. We are told, that in one county [†] the tenants in the neighbourhood of a wood, conceiving themselves greatly injured by the immense numbers of crows resorting to that wood, entered into an aſsociation for the purpose of destroying them; they aſseſsed themselves at the rate of five shillings, and latterly at two shillings, per plough; out of this fund they paid a bounty of a penny a head for old crows, and

[†] East Lothian.

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from 2 d. to 6 d. per dozen, as the season advanced, for young crows. The first six or seven years above 10,000 to 7 or 8000 were destroyed annually; and in thirteen years 76,635 were in all destroyed, the expense of which cost 142l. 14s. being a trifle short of 38 shillings per thousand; whereas, if the damage done by a crow in one year is estimated at one penny only, the waste committed by a thousand will amount to about 4 guineas. But the rat is far more destructive than the crow, especially when we reckon the damage they do to sacks, harneſs, &c. and the difficulty and expense of cleaning wheat when mixed with their dung.

Were such aſsociations general, and a premium given for every rat destroyed, they might soon be extirpated, and an immense quantity of grain annually saved to the nation.

ESSAY XVII.

On Fish Ponds.

BEING some years ago in Derbyshire, in the neighbourhood of Wingerworth, the seat of Sir Henry Hunlake, whose family were settled at that place before the Reformation, and have continued to profeſs the Roman Catholic religion ever since; I thought it a good opportunity to inquire, in what manner a first-rate gentleman's family of that persuasion, settled in a midland county, and at a distance from any large river, could secure a regular supply of fish, for the numerous fasts prescribed by that religion; as the arrangements for this purpose must have been contrived many years ago, and instead of being suffered to fall into decay, must have been preserved entire, unleſs perhaps improved by the experience of succeſsive poſseſsors, and the advance of science in the eighteenth century.

On inquiry, I found that an ancient man of the Roman Catholic persuasion, had for many years, managed the fish-pools of the family: I found him well versed in every part of his busineſs, even that of castrating carp, a practice nearly lost in this kingdom, and now disused by him, as he has found, by experience, that parting the fin, as he terms it, that is, putting male fish in one pond, and females into another, is a better practice, and liable to fewer loſses than the other; which is a delicate operation, and difficult to be practised with succeſs, especially by a person whose faculty of sight is not in perfection.

This old man informed me that Sir Henry Hunlake has forty-eight acres of land disposed into different ponds, and that this quantity of water affords a sufficient supply for the family, most of the servants of which are at present Protestants; the servants, however, I conclude, have been at all periods chiefly supplied by dried and salted fish, purchased at market.

Carp is the fish on which the certainty of supply may be said wholly to depend, though pike and perch are used, and eels also, that are always found at the bottoms of the ponds when they are drained.

The best feeding ponds will carry, by his account, from 20 to 25 carps an acre, which, when put in, weigh from half to three-quarters of a pound each; these, if under very favourable circumstances, will weigh from 7 to 8lb. a brace in seven or eight years, with a loſs of about three an acre: in general, however, as may be seen, from the statement below, the increase of the fish is not so quick.

Taken at this rate, each acre produces three carps a year, or 10½lb. of carp's flesh, and the whole forty-eight acres 504lb. a quantity very inadequate, even with the addition of perch, pike, and eels, to the supply of the master's table; our ancestors, therefore, must have consumed a large quantity of salted and cured fish; as indeed is fully proved by the ancient books of cookery and bills of fare that have been preserved.

The fast-days enjoined to the English Catholics in 1801, were 131; a decent dish of fish might therefore be served up to the master's table from this stock, on every fast-day; and this is probably all that was intended by the original arrangement. It is observable, however, that on account of the acknowledged dearneſs of fish in England, the number of fast-days enjoined to the English are considerably fewer than those required to be kept by those who inhabit the continent.

In the autumn of 1789 I had the opportunity of seeing one of Sir Henry Hunloke's ponds emptied, and the fish, which were of a proper size for the table, removed into the stews: I then learned from the fishermen the following particulars respecting the manner of stocking and managing it:

The pond occupies the bottom of a valley, through which a moderate brook runs, which affords a constant supply of water to the pond, and vents itself through the head by a large grate, constructed with cast iron bars: it was originally made for the use of an iron forge, and covers about ten acres of land.

It had been stocked ten years before with 200 store carp, about half a pound weight each; and five years after, a few pike and perch had been put into it.

The fishermen considers the pond as favourable to the feeding of carp, and estimates the usual loſs of the stock by death at about one per cent. in a year; the pond was therefore expected to produce 180 carps fit for the table; which it appeared to do, for though it was impoſsible to count them exactly, on account of the neceſsity of removing them to other ponds as soon as they were taken, there seemed no doubt, from the appearance of the fish, that the estimated quantity was produced.

The weight of the fish, which were very equal in point of size, was estimated at 7lb. a brace; a brace of the larger ones weighed 7½lb. Some pike, perch, and eels, were also taken, but the maſs of fish was carp.

Here then is a crop of carp very inferior indeed to that mentioned in the Annals of Agriculture, No. 219, on the authority of Roger North; for although each fish had, when put into the pond, one-twentieth of an acre, or 242 square yards to feed upon, the groſs produce was no more than 630lb. of carp; but whatever the reason may be, I cannot say I have ever eaten good carp, of

7lb. a brace, from waters that were stocked much harder.

The actual increase of carp's flesh in ten years is 530lb. which is 53lb. an acre, or 5¼lb. an acre a year; but supposing the stores to be worth nothing, and the whole 630lb. weight of fish clear gain, the produce will be 6½lb. weight of carp's flesh per acre a year, which at the London price, 1s. 6d. a pound, is worth in money 9s. 9d.

But good meadow land, on the banks of a brook, cannot be worth to the occupier leſs than 3l. a year per acre, so that as the proprietor of the pool is the occupier, the carp must be estimated to him at that rate; it may therefore be fairly said, that allowing something for the pike, &c. the carp stand him in 8s. 6d. a pound, or 28s. a carp; a price for which, in moderate times, a fat Derbyshire sheep may be purchased. But if he is considered as tenant to himself, as in the case of a park of deer, and satisfied if he receives rent only for land in his own hands, this cannot be taken at leſs than 1l. an acre, and his carp will cost him 2s. 10d. a pound.

Carp seem to thrive better in the southern than in the northern counties. Suſsex is noted for fine carp, probably on account of its woody tracts, where abundance of caterpillars and grubs fall from the trees, and are carried by the brooks into the fish-ponds. It is remarkable also, that ponds on large commons feed carp very quickly, owing to the dung of the cattle that stand in them in hot weather. Derbyshire is not only a northern county, but is considerably elevated, which makes its climate colder and leſs advantageous to the growth of fish.

A pond of thirty acres near Lamberhurst, in the woodland district of Suſsex, originally stocked with twenty carps or tench to the acre, but which, when drawn, did not produce more than fourteen, owing to four pikes, which had probably bred in it from spawn left when it was cleared out, yielded in nine years carp from 10lb. to 12lb. a brace; and tench from 7 to 8. As this pond is in a district famous for good carp, and as it was much understocked, it is probable that so quick an increase in size does not often occur.

Slowly as carp and other mud-sucking fish grow in this climate, even when they have abundant room to feed, fish of prey, if they have plenty of food, increase in size much faster.

In the autumn 1797, a pond in Middlesex was emptied, in which various kinds of fish had been kept for several years, and among the rest perch, none of which had ever been observed to attain the weight of half a pound; and in order that all the fish in it, and their spawn, also might be destroyed, the pond was left dry for more than a week.

In the spring, 1798, gold fish were put into it, and observed to breed very fast. In July, 1800, a perch was seen in the pond, the weight of which was judged to be little more than a quarter of a pound.

In July, 1801, the perch was again seen and observed to be very much grown, but as the pond was full of water plants intended for ornament, it was not thought proper to disturb them in order to catch it; in April, 1802, however, the perch was caught, and found to weigh 1 lb. 10 ounces.

As it is not probable this perch could have lived a week in the pond when drained of water, unleſs in the form of spawn, it was most likely hatched in the spring of 1798: if so, it was four years old when caught.

In July, 1800, when it was two years and a quarter old, it weighed little more than one quarter of a pound; a size at which perch are scarcely able to prey on other fish; it therefore increased after that period 22 ounces in 20 months, or more than an ounce a month summer and winter: it no doubt fed on the fry of the gold fish, which were abundant in the pond.

In October, 1794, a pike was caught in Lincolnshire, in the pond of a gentleman whose family had been for many generations Roman Catholics, and whose servants, of course, were well versed in the management of fish. It weighed 31 lb. and measured from the tip of the beak to the extremity of the tail, three feet ten inches; its thickneſs at the shoulder, gauged by a pin thrust through, was four inches 5-8ths.

The pond in which it was kept, had been stocked only twelve years before with small pike, none exceeding a pound weight; notwithstanding which, some of eighteen and twenty pounds weight had been taken within the last three years: the growth of this fish must therefore have been two pounds and a half annually for the average of the twelve years in which it had increased from 1 lb. to 31 lb.

The pond in which it was taken has a communication with a small river well stocked with fish of all kinds, so that its supply of food had always been abundant; and though fish of so large a size are in general tough and ill-flavoured, this was as tender and as juicy, and as sweet as pikes of 6 or 7 lb. usually are.

Fresh water fish in general, and carp in particular, are admitted to be delicious food when in season, in good condition, and of a proper size: all persons, however, who are fond of fish, must have remarked, how very seldom this article of luxury is met with in perfection.

Fish can live a long time without food; the fry of fish even increase in size considerably without taking any visible nourishment; it is probable that even mature fish receive enough of nourishment to preserve life, by absorption through the pores; but that when they have no other sustenance, their fat and some of their juices are taken into the circulation and destroyed. They become fat and juicy by regular feeding, or in waters that produce plenty of food; but as they can fast for a great length of time, and are always disinclined to feed when in waters they are unacquainted with, they soon become lean and insipid when kept in a stew.

Carp are sweet and well tasted when taken out of the muddiest ponds, where plenty of food can be obtained, and the stock of fish is not too large: in clear water they soon become lean, and acquire the taste we call muddy: a stew made in the clear channel of a trout stream produces this effect on the finest carp in a very short time; indeed the sale of carp in London, which formerly was an article of advantage to some estates, particularly in Surry, where carp were bred for the market, is now in a manner lost by the management of the persons called Live Fishmongers, who purchase carp in considerable quantities, and keep them alive many weeks for the supply of the London market, in large cages of wood placed in the Thames near the water-works under London bridge.

To have carp in perfection they must either be eaten immediately after they are taken from the pond in which they have been nourished, or they must be put according to Roger North's method, early in the autumn into stews, and fed regularly from the first commencement of warm weather in spring, till the whole stock has been consumed. This, however, will not be found an economical management; an experiment was tried by feeding carp in a pond with boiled pease suspended in nets, through the meshes of which the carp sucked the pease: it was amusing to see the tops of the hazel rods by which the nets were suspended, bend and wave as the fish pulled at the nets; and as this was almost continual, it appeared that carp are seldom idle when their food is agreeable to them; like horses in a pasture they were always eating; they became fat in a few months; but though no regular account was kept of the quantity of pease they devoured, it was evident, by the consumption, they were not cheap fish when they came to table.

When carp are not fed they are continually grabbing in the mud at the bottom of the pond in which they are kept, and it is this which makes the colour of the water in the ponds where carp are kept always muddy. Complaints on this head are often made by persons who have ornamental water; and it does not appear to be known, that in most cases the water may be rendered transparent in a great degree by destroying the carp and tench, and stocking with pike and perch, and float fish, as roach, dace, &c. for their food.

ESSAY XVIII.

On Farm Stables.

ALTHOUGH there is no neceſsity for fitting up a farmer's stables in that style of magnificence which is sometimes bestowed on the accommodation of hunters and race-horses, yet the farmer's horses are nevertheleſs as much entitled to a comfortable habitation as any of these.

In general farmers are by far too negligent of the accommodation or comfort of their horses. They seem to think that any sort of a hovel is sufficient for a work-horse.

Were they only to bring the case home to themselves, and to consider how refreshing a thing it is, after the fatigues and toils of a day, to have a wholesome room and a comfortable bed to retire to at night, they would perhaps have some degree of compaſsion on that noble and useful animal, on whose labours and exertions their own comforts so much depend. Eager to obey the will of his (often) ungrateful master, the horse strains every nerve to accomplish his imperious commands. At the conclusion of the day, fatigued, perhaps, till his strength is almost exhausted, how barbarous it is to put this faithful, this valuable servant, into a miserable tottering hovel, where he can neither lay down to take a little rest, nor stand up to taste of his scanty morsel without being wet or besmeared; and this too from the carelеſsneſs and ingratitude of those who depend on his exertions for their daily support. If a farmer would only consider how much he is indebted to this precious animal, he never would suffer him to be so shamefully neglected. Is it not the horse that ploughs his ground?

is it not the horse that harrows in, and often sows the seed? is it not the horse that carries home the produce? and is it not the horse that sometimes thrashes it out, and always carries it to market? How then can we account for that matchleſs ingratitude and neglect which is so undeservedly shown to this valuable creature: but that such is the case in many places is a truth too notorious to be denied. If it is likewise considered, with how much more alacrity and vigour a horse will enter the yoke after a night's comfortable repose, than he will do after hardly any repose at all, the farmer will at once see how much it is to his own advantage and profit to pay the strictest attention to the comfort, as well as to the food, of his horses: the difference may be equal to at least an hour's work in a day, or about an eighth part of his labour, the value of which he may easily calculate.

There is nothing more conducive to the health of a horse than a wholesome, dry, and well aired stable, and of such a construction as to keep out the cold in winter, and the heat in summer, with proper drains to carry off every sort of moisture.

We are told by some who have made the management of horses their principal study, that there is no animal delights more in cleanlineſs, or that more dislikes bad smells. And yet how often do we find, even in stables built at a great expense, that they are so wretchedly ventilated, and the effluvia from their dung so disagreeably powerful, we can hardly breathe on entering them. How much more disagreeable and offensive must it be to the horses themselves, who poſseſs so exquisitely the sense of smelling, to be thus doomed for hours and whole nights together, to breathe the offensive vapours arising from their own dung. Yet, as if that were not sufficient to torment their olfactory nerves, a he-goat is often introduced in the stable; an animal which, of all others, "has the rankest compound of villainous smell that ever offended "nostril." There are some people credulous enough to believe that such smells are wholesome, and prevent diseases among horses: for my own part I can never be persuaded that any sort of smell, or the breathing of any sort of air, can be half so salubrious or agreeable to horses or other animals, as the pure unadultered air of the atmosphere. For this reason I would recommend all stables to be extremely well ventilated, especially at the top, where the foul and offensive air may much sooner and easier be conducted away, than at any other part *.

As farm stables are almost always built adjoining to other offices, as indeed they ought to be, it is unnecefsary here to say any thing concerning the choice of situation; but as there are several ways of constructing the stalls, it is hoped the following observations will be sufficient to explain them.

The most common way is to make the rack and manger to extend the whole width of the stall, the upper part of the rack inclining over the manger. Although this is the most general, it is the worst of all constructions, nor is it the least expensive.

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* In every stable there should be a few proper sized windows, in proportion to its extent; which windows ought to be so contrived as to open or shut at pleasure, either to admit the air or to exclude the light, as may sometimes be necefsary to induce the horses to take a little sleep in the day time. In farmers' stables, when it is not wished to go to the expense of sashes and glafs, they may be so constructed as to have a shutter exactly fitted thereto, which is suspended in the middle by two iron pins upon which it turns.

Servants are for the most part so sparing of their labour, that in order to save a little trouble they will cram a rack quite full of hay, whatever is its size. Those who are acquainted with the management of horses well know the bad consequences attending this practice, and that it is much better to give a horse little at a time, and often, than to put it in his power to stuff himself with more at once than is good for him; besides, when this is the case, he generally wastes a great deal of hay which falls down among his litter; and according to this construction of a rack the whole seed is lost, which if saved, and of good quality, might be of some value to the farmer; for an industrious farmer will save every thing he can; and even the seed of the hay used in his stables is very well worth his attention.

When the rack is inclined outwards in this manner, the seed very frequently, too, drops into the horses eyes and ears, and is attended with very bad consequences.

For these reasons the rack should always stand perpendicular, at the distance of about fourteen inches from the wall.

Sometimes there is a niche left in the wall for the rack, the spars of which are in that case flush with the inside face of the wall. This niche and rack, which is supposed in the middle of the stall, need only be about 2½ feet wide, and should be carried low enough to admit a small box, or drawer, at the under part of it, to receive the seed.

These racks are sometimes made in the corner of the stall, so as to make one niche serve two stalls; and they are sometimes put in the angle, without any niche, in the form of a semicircle.

In either case, there should always be a division of deal betwixt them; for it is best for the farmer to know what each of his horses eats, which he can never do when two eat out of the same rack and manger.

When such racks are made in the corners of the stalls, I should rather think it would be better to make them straight than circular.

There may either be a hatch over each of these racks, or a single hatch for putting down the hay in any other convenient part of the stable, with rails, and a sparred bottom to save the seed; but for farmers it is perhaps the better way to have a hatch for each stall, which will require leſs time to feed the horses than the other way.

It is unneceſsary to make the manger the whole width of the stall; a drawer, or box, about 18 inches long, by 12 inches broad, or even leſs, is quite sufficient. This drawer should be made so as to be taken easily out to be cleaned, for it is a great objection against standing mangers, that whatever drops from the horse's mouth or nostrils, in case of a cold, or any other disorder, is seldom or never cleaned out.

Some stables are constructed without either racks or mangers: the inner part of the stall is boarded for about three feet high from the ground: the boards about two feet diſtant from the wall: the hay is put into this place; by which, instead of having to pull his hay from above, as is commonly the case, he takes it from below, which is perhaps not only more natural for a horse, but there will be much leſs waste than by drawing it from a rack, for every time the hay is drawn from the rack, there is generally some of it drops down and is lost; but when it is taken from below, whatever drops, falls back among the rest, and consequently none can be lost. It would be proper to have some small spars at the bottom of this place, within about six or eight inches of the ground, and either with a drawer for the seed to fall into, or a board with a couple of rings, to take away when required; or perhaps a better construction would be, nearly in the form of a hopper, being only about 14 inches wide at bottom, which is sparred, and a drawer below it for saving the hay-seed. In the corner of the stall is a little box to hold the horse's feed, as described already; and if a double stall, there is a box on each corner, and the hay-manger, if it may be ſo called, is divided in the middle: in general, however, single stalls are to be preferred.

The next thing to be considered, is the manner of paving the stalls. For my part, I think that horses ought to stand in a stable as nearly on a level as poſsible; nor can there be any reason whatever to the contrary, unleſs that of carrying off the moisture; which I hope to show may be much more effectually done by paving the stalls level, than in the common way.

A horse's feet are of so much importance to his master, that no pains should be spared to keep them in the best order and free from every blemish or complaint, for the least flaw, or the least injury there, may render him incapable of work, perhaps altogether uſeleſs.

Nothing can be worse for a horse's heels than to make him stand always on a slope or declivity. It not only occasions grease, cracks, scratches, &c. but by keeping the tendons and sinews of his pastern joints in a constant state of extension, causes a stiffneſs in those joints, which must prevent him the free use of them. Nor can a horse rest so easily on a slope as on a level.

It must be observed, that the pavement or floor of the stall, instead of being perfectly acroſs, should decline about an inch, or an inch and a half from each side towards the stall drain; a declivity which will not be perceivable, but will prevent any water spreading towards the sides, in case it does not fall immediately into the drain.

The advantages of this sort of stall are, that the horse always stands upon a level, and consequently will be leſs liable to disorders in his feet or heels; that as horses generally stale about the middle of a stall, and as the bottom of the stall drains may have a much greater descent than can be given to the floor of a stall, the urine will be carried off immediately, without spreading to either side, as must be the case in the common method, for which reason horses may be kept dry with leſs litter, if required.

Stalls should never be leſs than five feet wide, although I have known them only four feet and a half, and not attended with any inconvenience. The division between them should be so high, that strange horses may not see each other*.

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* Sometimes stalls are made double, and as farm horses generally work in pairs, each pair that work together have one of these double stalls; for horses are a sociable animal, and it is said they feed better, and are more cheerful

ESSAY XIX.

On the Size of Farms.

THE comparative produce of great and small farms, is a question of great importance, and is highly deserving of our most serious attention. It is a subject on which no person can stand neutral, but must take a decided part one way or another. Much has been said upon it, but very little proved—because it is very difficult to form calculations, that would be conclusive, unleſs real occupiers could be induced to lay open their profits and expenditure, which cannot be expected; it is therefore from observation and conjecture, that

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cheerful when they live in society. But even in this case it is proper they should be fastened to the opposite sides of the stall, and that each horse should have his own rack and his own manger; for although they may seem to have a very great attachment to each other (as it is evident they often have), yet if the dividing of their food is left to themselves, it is more than probable they will quarrel about it, and that the strongest horse will have the best share.

arguments *pro* and *con* can be deduced. It should, however, seem, even upon a slight consideration of the subject, that agriculture, when it is thrown into a number of hands, becomes the life of industry, the source of plenty, and the fountain of riches to a country; and that monopolized and grasped into a few hands, must dishearten the bulk of mankind, who, by this means, are obliged to labour for others, instead of themselves, must leſsen the general produce, and greatly affect the community at large.

The arguments generally made use of in favour of large farms, are, that a great expense is saved in repairs and labour, particularly in doing the culture with a leſs number of horses; that a large capital in farming is as neceſsary as in trade; for without a large capital, no considerable improvement can be undertaken or effected, nor a proper or suitable stock kept upon land; and, that as to corn, heavier crops are grown, by means of the land being better worked and manured.

The arguments for small farms, are, that they reward merit, encourage industry, fill the markets with plenty, increase population, and furnish the best claſs of men in all subordinate stations of life.

As to the first, respecting repairs, it must stand admitted: but, as an ample drawback from that advantage, the land is, in general, let at least 20 per cent. cheaper in large, than it is in small farms. As to its being done with leſs expense, that is, with a leſs number of horses, if that were a fact, it would certainly be a great advantage to the public; but, when the great farmer's riding horses, and, sometimes, other horses of pleasure and luxury, are added to those used upon the labour of a farm, no credit will be due to this aſsertion.

That a sufficient capital is as neceſsary in farming, as in any branch of commerce, must be allowed; but it does not hold good, that because a man has but a small capital, he ought not to be suffered to make use of it at all; such doctrine would be absurd, impolitic, and inhuman.

That a large capital is more equal to great improvements, than a small one, is self evident; but, except in some few instances, I cannot see why the latter should not keep pace, in a proportionate degree, at least, with the former. Respecting stock, no one can presume to say, that a little farmer can set a fold so well as a great farmer, but he generally keeps more milch cows, in proportion, than the latter, which makes ample amends to the public.

As to corn, I am not inclined, even in this instance, to allow, that better crops are grown by the great, than the small farmer, unleſs it be by means of the former having a sheep-walk, or some other similar advantage over the latter.

So far, I have endeavoured to carry on a comparative statement between great and small farms, as far as relates to a general answer to the common outlines of observation on them: but there are other remarks to be made, of great consideration—the first is, as to the effect they have upon society at large. Here, I believe, it will be pretty obvious, that if there were none but great farms, the common articles of consumption in every family would be so diminished, that the middling race of mankind would not be able to supply their tables, and the common labourer would be absolutely starved; for there would be no butter, cheese, pork, eggs, or poultry, to be bought, as great farmers raise no more of these articles than they require for their own consumption.

If great farms only are to be encouraged, which seem to be the aim of some, husbandmen of small capitals, let them be ever so industrious, will be effectually cut off from the common means of raising themselves in life, as there will be no channel for their introduction. Population will likewise receive an irrecoverable blow from the supprefsion of those little hives of plenty. But most great farmers, and, I am afraid, some authors of eminence upon agriculture, and even upon population, may, perhaps, differ with me in opinion. I am not vain enough to suppose, that any thing I can say will alter their opinion, but, for the sake of the community, and the particular comfort of the middling and lower clafses of society, I hope it may have some weight with gentlemen of landed estates, who are the natural guardians of the latter, and who would find their consequence much augmented, by a closer attention to the inferior husbandmen; and I am greatly mistaken, if their fortunes would not likewise be improved by it.

The complaint against great farms is not of any long standing—the evil (if I may be allowed to call it so) seems to have increased in proportion to the decline of fairs and pitched markets. If it were the custom for the great farmer, as formerly, to bring his corn to the public market, as is still the case in some places, the home districts would never be short of corn; but while the great farmer and miller are allowed to settle large bargains in a private room, from the exhibition of a mere pocket sample, a country may at any time be kept in the dark as to the real quantity of corn in it, and little farmers, by this means, must be quite ruined. I wish, therefore, to see fairs encouraged, and public markets revived: the last of which are all reduced, in the county of Norfolk, (as far as relates to corn) to sale by sample only.

But, after all, it is the exceſs of the grievance which I wish to correct.—The evil is now so great, that there are many farms of 1000 l. a year in the county of Norfolk, and Mr. North's farm at Rougham, was lately 1700 l. but I have the satisfaction to be able to say, that he is now dividing it into four. The letting lands in such large farms, as this was, is evidently bad policy, if it were merely as to leſsening the choice of tenants; for where they have one, in the present instance, capable of carrying on such farms, they would have twenty in the other.

I will, however, admit, though I am an advocate for small farms, that, as the country is now situated, no farm should be under 30 l. or 40 l. a year, and even these should be dairy farms, nor would I have any arable farm under 50l. I will still go farther and say, that the greatest number should be from 80 l. a year to 150 l. none ought to exceed 200 l. where the land is of a good quality; or 500 l. even upon the poorest land, where great farms, on account of a large stock of sheep, are most admiſsible. The greater the difference in their size, between the preceding extremes, perhaps the better, as they will better play into each other's profits; some will raise cattle to more advantage than they can fat them, and others will fat them to more advantage than they can raise them.

I have made these remarks with freedom, but I trust, with temper and good manners to those of an opposite opinion, and shall be happy, if what I have advanced should have any effect upon those in whose power it lies to correct the grievance complained of.

ESSAY XX.

Experiments and concise Agricultural Observations.

THE mode that I have adopted in the former Volumes of those Eſsays of placing together such observations and experiments as were of a compreſsed nature, having been generally well received, I propose to follow the same plan in all the succeeding Volumes, should the selection be continued beyond the present year.

A. H.

1. *On Stall-feeding Horses with Tares*[*].

Having found from experience the great utility of green food, in the summer, for horses used in husbandry, to the saving both of corn and hay, I sowed last spring about nine acres of tares in drills; and also, by way of trying the difference, about six acres in the broad-cast way, the old method, which, till of late, I used to follow.

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[*] By Mr. Thomas Hayes.

The tares sown in drill I found to turn out much superior to those sown broad-cast; the crop being greater, though the seed was only about half the quantity.

The produce of these tares was so great as to enable me to feed all my draught horses, to the number of twelve, and sometimes thirteen, during part of the spring, and all the summer season (in all about four months, from May to October), upon this food wholly, except some few beans and bran *, when they worked hard. This was the case when they ploughed some of the very strong heavy clay land, which required from six to eight horses, when, in other parts, three or four would do as well; and in my other farm, where the land was thin and light, two horses would perform as well as six will in some parts here. Besides the horses, there were five milk cows, and a bull, fed with those tares in the farm yard.

The dung hereby produced and preserved for manure, was of course very abundant and useful to me; much more so than had the

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* 24 bushels of beans, and 96 bushels of bran.

dung been dropped by the cattle in the fields, as in that case the virtue would have been in a great degree exhaled by the sun: and in particular places, where it was dropped in heaps, and not spread, it would have done more harm than good.

Besides, when the cattle are suffered to tread in the crop they feed upon, they often destroy more by treading, than they consume by feeding. The milk of the cows is also much increased in quantity by being stall-fed, and turned out morning and evening to water; the cattle are kept sheltered, during the hot months, from the great heat of the sun, and prevented from being tortured by the flies in the field.

The horses were employed this time constantly in the neceſsary husbandry buſineſs; sometimes in ploughing land, which is exceedingly hard and heavy, as I have before observed, and sometimes in carrying out manure upon the land; often sent with loads of hay and straw to the London Market, and bringing back dung, or soap ashes, to put upon the heavy lands. During this time, the horses looked remarkably well, and were generally healthy, much better than they have been since they returned to be fed upon corn and hay.

This has induced me to sow a quantity of winter tares, which I expect will be ready for use in April: and as I find them so beneficial, I intend also to have some acres of summer tares, to feed all my horses in the stable, the ensuing summer, as well as my cows in the farm yard. As I cut some part last year, besides what I fed the horses and cattle with, I consider there was not above twelve acres consumed by them; and each acre, considering the intrinsic value of the land the tares grew upon, which was some of the lowest quality of the farm, stood me at no more than 30s. the value of the seed, ploughing, &c. included.

2. *On Cows proper for the Dairyman and the Butcher*[*].

Some argue that the dairyman and the grazier, distinctly considered, require different animals to suit their respective purposes. The dairyman's object is *milk*; the grazier's *beef*; and it is a trite remark among dairymen in different districts, that a cow which "runs to beef" is unprofitable to the dairy; for notwithstanding the excellency of her bag, and the plentifulneſs of her milk, presently after calving, her natural inclination to *fleshyneſs* draws off her milk: While a cow that is by breed, or natural constitution, prone to milk, will supply this at the expense of her carcase, let her pasture be ever so plentiful.

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[*] By Mr. Marshall.

These popular opinions, however, though they contain much truth, are not altogether well founded. They hinge on a false principle. Cows are useful, and in a great degree necessary, in a twofold capacity; as dairy cows, and grazing stock. The dairyman and the grazier cannot have distinct animals. One and the same individual *must* serve both their purposes; and a breed of cows fit for the grazier only, is, in a general light, not leſs eligible, than a breed which is fit only for the dairyman.

3. *On the Winter Management of Winter Pastures*[*].

A gentleman in whose superior management I more particularly observed this admirable practice, shuts up, from the middle of September to about old Michaelmas, as the age of the graſs, the season, and other circumstances suit, making a point of eating the ground level, previously to its being freed from stock, from which it is kept free until it be wanted for ewes and lambs; or, if it be intended for cattle, until the first shoot of graſs in the spring; which mingling with the autumnal shoots, the herbage is found to be more nutritious to stock, than either of them separately. As a certain and wholesome supply of food for ewes and lambs, in early spring, this PRESERVED PASTURE is depended upon, for the sheet anchor, in preference to turnips, cabbages, or any other species of what is termed SPRING FEED.

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[*] By Mr. Marshall.

4. *To prevent Hares and Rabbits barking young trees*[*].

Hares, rabbits, and rats have a natural antipathy to tar; but tar, though fluid, contracts, when exposed to the sun and air for a time, a great dryneſs and a very binding quality, and if applied to trees in its natural state will occasion them to be bark-bound. To remove this difficulty, tar is of so strong a savour, that a small quantity, mixed with other things in their nature open and loose, will give the whole mixture such a degree of its own taste and smell, as will prevent hares, &c. touching what it is applied to.

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[*] By William Paterson, Esq.

Take any quantity of tar, and six or seven times as much grease, stirring and mixing them well together: with this composition brush the stems of young trees, as high as hares, &c. can reach, and it will effectually prevent their being barked. I believe, if a plantation of ash (which rabbits are very fond of) were made in a rabbit warren, this mixture would certainly preserve it.

They do great mischief amongst flowering-shrubs, and are particularly fond of Spanish broom, Scorpion-senna, and Evergreen Cytisus; I have had these shrubs eat down to a stump; but, as the mixture cannot conveniently be applied to them, I have inclosed their branches with new tar twine, by putting it several times round the shrub, which has had the desired effect. Tar twine by being exposed to the air and rain, will lose its smell, consequently it must be renewed as occasion may require; but the mixture is always to be preferred where it can be used.

5. *Engrafting Bark on injured Trees* *.

Some fatted sheep were turned into a valuable orchard of mine of about twenty years growth, and they, in a short time, stripped the bark from several of the trees entirely round the bodies, leaving the wood bare for at least sixteen inches.

I was so much hurt by this accident, as to determine to do something for the preservation of the trees, and save them if poſsible. The first step that I took was to take off the arms from several of the trees which were most injured; and, from the largest of those arms, I flawed off slips of rind of about two or three inches in width, and placed four or five of them perpendicularly round the naked part of the body; but I should observe, that I first cut away all the rind that was bitten, and then raised the rind up top and bottom, and put the ends of the slips under, that the sap might circulate, and afterwards bound them

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† By W. Fairman, Eſq.

exceedingly tight with rope-yarn; I then applied a composition of loam and cow-dung, with a little drift sand, over which I tied some old sacking, and this was the whole of the proceſs.

The experiment being made in the spring of 1794, a minute inspection at this time must determine the fate of it; and permit me to say, it has succeeded far beyond my expectation: the slips adhere as close, and are as full of sap as the rind on any other trees. They are now (May 16, 1794) in their full bloſsom, strong and vigorous, apparently, as if they had received no injury. But I must observe, were I to make the experiment again, I could do it more dexterously; and I must mention an error I was guilty of in my haste, by placing some of the slips the wrong way upwards, consequently the sap could not circulate.

6. *On Hog-sties**.

Hog-sties should be larger than common, and walled round; before winter, the area should be covered eighteen inches, or two feet deep, with marl, chalk, turf, loam, &c.

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* By Mr. Wimpey.

and upon that bed the hogs should be kept, fed, and fattened through the season, without any cleaning out. This part of it I have seen in Bedfordshire, where I was aſsured that the dung raised by fattening hogs, thus kept under cover, after the manner of a covered sheep-fold, and never stirred till barley-sowing, has proved as good, and went as far, as pigeons' dung. In this there is nothing inconsistent with reason, for no management improves dung so much as keeping it from the rain, sun, and wind, in which respect pigeons' dung is singular. By following this method, the hog-sties will be made to yield a great quantity of the most valuable manure that the farmer can poſseſs. It excels all common dung, and is second only to night soil.

7. *On Ridges*[*].

In laying down land either for corn or pasture, particular care should be taken to throw the ridges as near north and south as poſsible. Instances are known where they have been laid east and west, and in large round lands, when the south side has yielded double. This is an important consideration, though seldom attended to.

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[*] By Mr. John Holt.

8. *On the Package of the Animal Maſs**.

I know nothing so surprising as the package of the animal maſs. Examine the contents of the trunk of any large animal; take notice how soft, how tender, how intricate they are; how constantly in action, how neceſsary to life. Reflect upon the danger of any injury to their substance, any derangement of their position, any obstruction to their office. Observe the heart pumping at the centre, at the rate of eighty strokes in a minute: one set of pipes carrying the stream away from it, another set, bringing, in its course, the fluid back to it again: the lungs performing their elaborate office, viz. distending and contracting their many thousand vesicles, by a reciprocation which cannot cease for a minute: the stomach exercising its powerful chemistry: the bowels silently propelling the changed aliment; collecting from it, as it proceeds, and transmitting to the blood an inceſsant supply of prepared and aſsimilated nourishment: that blood pursuing its course; the liver, the kidneys, the pancreas, the parotid, with many other known and distinguished glands, drawing off from it, all the while, their proper secretions. These several operations together with others more subtile, but leſs capable of being investigated, are going on within us at one and the same time. Think of this, and then observe how the body itself, the case which holds this machinery, is rolled, and jolted, and toſsed about, the mechanism remaining unhurt, and with very little molestation even of its nicest motions. Observe a rope-dancer, a tumbler, or a monkey; the sudden inversions and contortions which the internal parts sustain by the postures into which their bodies are thrown; or rather observe the shocks, which those parts, even in ordinary subjects, sometimes receive from falls and bruises, or by abrupt jerks and twists, without sensible, or with soon recovered damage. Observe this, and then reflect how firmly every part must be secured, how carefully surrounded, and how well tied down and packed together.

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* By William Paley, D D.

9. *On Dung left on Summer Pastures*[*].

I apprehend that the dung left by horses and horned cattle upon summer pastures, adds but little to the fertility of the soil, on account of its long exposure to the sun and winds. It would therefore be more correct husbandry to gather it up within a few days after it is dropped, and carrying it to a corner of the same field, let it be occasionally mixed with earth. This compost when laid upon the same field at a proper season, will produce more graſs than if it had been suffered to remain upon the surface in its original form, as generally practised. Sheep are an exception to this mode of improvement, as their dung, falling in trundles, naturally spreads itself. Dung being the life and soul of husbandry, the farmer cannot be too attentive to its formation and application; and in order to bring him to a due sense of its importance, I shall hazard a degree of ridicule, by advising him to "spit upon no man's land but his own."

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[*] By A. Hunter, M. D.

10. *Importation of Corn injurious to Farmers**.

Farmers are exposed by the existing corn laws, to one inconvenience peculiar to their profeſsion, which affects not the busineſs of any other claſs of men. Every manufacturer, every tradesman, every vender of the produce of his own labour, except the farmer, enjoys the right of supplying the home-market with the commodities which he offers for sale, and is protected in the privilege of receiving gain from his industry. But whenever the badneſs of the season and the scantineſs of the crop, which ought in fairneſs to be felt by the whole nation, affects the farmer's resources, the ports are thrown open; and instead of enjoying the exclusive profit of his own commodity, when he may stand most in need of it, his gain is snatched from him by persons who speculate in importing foreign grain from countries, which, by paying lighter taxes, can afford to undersell the British farmer. However, in every other article of his produce, the farmer enjoys, in common with the manufacturer, the privilege of selling th produce of his labour at his own price. Th inconvenience arising to the farmer in conſequence of importation, is, in some degree, balanced by the bounties granted to him by Parliament, after a plentiful harvest. But, after all, the interference of Government is nothing more than granting protection to the public against combinations formed after a scanty harvest.

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* By James Robertson, D. D.

11. *On Folding**.

As soon as poſsible after folding, the plough should turn in the manure; the variations of the atmosphere will otherwise carry off the principal part of the benefit; for this reason, also, the fold should be set at different seasons for different crops; early in the spring for barley; afterwards for turnips; and after that for wheat. The degree should depend upon the poverty of the soil; a square yard to every sheep, and the fold shifted every night, is but a slight dreſsing for one crop; the same for two nights is a good dreſsing for one crop, and will be seen in that which succeeds. Something leſs than a yard, and two nights in a place, is a very good manuring.

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* By Mr. Wimpey.

Upon extremely poor blowing sands, top-folding is an excellent practice; that is, running the fold over the field after it is sown with any crop, and even after it is come up; the treading of the sheep settles those porous soils to the roots of the corn, and has a very great effect.

In Hertfordshire little farmers, that have only two or three score of sheep, will fold them, but the trouble and expense runs away with more than the profit. In general it may be established as a maxim, that it is a buſineſs that goes on with no advantage, unleſs a shepherd is kept, who sees that the driving to fold is done in a manner not to injure the sheep more than neceſsary: It is a work not to be trusted to boys, or any careleſs hand that happens to be on the farm; a shepherd cannot be kept for leſs than four or five hundred sheep. As he can take care of eight hundred, or a thousand, there is a loſs even with four or five hundred.

12. *On Fish Ponds**.

When a fish pond is frozen over, the fish are often killed for want of air. Every pond should therefore have a bolt, or standard, to draw off two feet of water occasionally, to clean the sides from rubbish; and, by drawing off a little water in severe frosts, the ice will crack, or it may be opened, so as to afford the fish a sufficiency of air to breathe.

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* By Sir Edward Littleton, Bart.

13. *On Barley sown with Lucern*[*].

Two acres of land were thoroughly dunged and prepared for lucern, which were sown with buck-wheat in the spring of 1795, and was destroyed by the fly soon after it came up. It was then ploughed and sown with turnips, which were eaten off by sheep in November; then ploughed and lightly dunged, and sown broadcast with lucern the latter end of May, 1796; at the same time eight gallons of barley were sown with it, which produced at harvest one hundred and twenty four bushels and half a peck; and the lucern was quite thick enough upon the ground.

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[*] By William Hale, Esq.

14. *Covered Sheep-Fold**.

The common method of folding sheep is a practice well known in many parts of this kingdom, but the covered fold is no where general in England. In various parts of Europe, however, it is regularly done, and among the Romans it was common husbandry. The method I would recommend, is to open some out-house adjoining the farm yard; or build a slight shed in any convenient part of the farm, inclosed with a high pale, in such a manner that the sheep may either be under cover, or exposed to the weather as they pleased; that is, to have an apartment sheltered, and a small area before it inclosed. The whole to be covered with marl, chalk, turf, or loam, twelve inches deep, and then well littered regularly through the winter, with whatever litter the farmer has in plenty. The advantage of this practice is very great; a few sheep cannot be folded in the common manner with any profit, for the expense and trouble of constantly moving the hurdles will over balance it; but in the standing fold, the case is different; a score of sheep will, in a winter, make a dunghill that is a real object.

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* By Mr. Wimpey.

The value of the dung thus raised is much greater that any one can suppose that has not tried it. Ewes and their lambs, in cold driving rain and snow, lie sheltered and warm, and do much better than when exposed to such weather, especially if you give them hay in ricks, which should be always practised in such standing folds. In Flanders where this husbandry is practised, they strew their houses with sand instead of litter. I apprehend that the sheep in that case, would not be so clean, and dry, and warm as when well littered; however where very dry sand is to be had, it must be a succedaneum very well worth trying.

15. *On working Oxen*[*].

If it is a fact, which cannot be disproved, that oxen, in some sort of work, are equal to horses; in these cases they certainly ought to be preferred, because they are kept at considerably leſs expense, and leſs casualty attends them. It evidently would be much for the advantage of this country, if oxen were in higher estimation than they are: upon every farm where three teams are kept, one of them, at least, ought to be an ox team; for though oxen would not, perhaps, entirely answer the end, to the total exclusion of horses, there is, undoubtedly, a great deal of work that they would do as well, particularly in carting and all heavy work. In most instances, they are nearly equal to horses, and in their support they are full thirty per cent. cheaper. At present no farmers use them in Norfolk; but Mr. Coke, Mr. Colhoun, and some few other gentlemen, occasionally do, and I hope their example, ere long, will be followed by the farmers in general. It was with infinite satisfaction, that I some time since learnt, that Lord Hawke, whose experiments in husbandry are very extensive in Yorkshire, has there set an example of ploughing with two oxen to a plough only, which is attended with complete succeſs, as they plough nearly as much as an equal number of horses; and if the cheapneſs of their keeping, and other circumstances in their favour, are considered, they are certainly preferable to horses. There is in this country (Norfolk) a strong prejudice against this generous animal, which is the first thing to get over; when that is removed, the credit of the ox will soon follow.

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[*] By Nathaniel Kent, Eſq.

The principal advantage that the farmer

would derive from oxen, is in the moderate expense of their food, and in their being attended with leſs risk.

The best way is, however, not to over-work them, for in that case they will require rather more hay than a horse, and half as much corn, and if they are suffered to fall into low condition, it will require considerable expense and time to get them up again.

The plan that I have found to answer best, is this, suppose four were called a team, which, in this country, would be enough, and that one man was appointed to attend them: I would rather advise six, instead of four, to be the team, as one man might attend them at the same expense as four, but I would only work four of them at a time, and let two of them rest two days out of the six, by which means, they would, in fact, work only four days out of the seven. In the summer months they should have a pasture to run in, where there is plenty of water, and an open shed where they should have a bait, the day they were worked, of green vetches, cut graſs, or any thing the farm might furnish. In the winter, they should be kept in a yard, with the same sort of shed for them to run into at pleasure, and here they should have plenty of barley or oat straw, and offal turnips, and in the days of working, cut hay and straw, and turnips besides. In this manner, they will, in general, do extremely well, and will, at all events, earn as much as the value of their keeping, so that their work will be had for nothing. Another great advantage is, that in case of falling lame, there will be no diminution in their value; but if a horse falls lame, half his value is lost. So far I have described the advantage of the ox to his employer; but to the public, the advantage is superlatively striking. The ox when labouring, does not consume so much corn as the horse, for, according to my plan, he would not consume any; and when his labour is done, his carcase goes to the nourishment of man; but the body of the other is good for nothing but to feed dogs.

The more the number of horses can be leſsened, the better for all ranks of people: the consumption by horses, especially horses of pleasure and luxury, is astonishing; for though a horse employed in agriculture does not consume above the product of three acres in a year, a horse kept for the road, eats easily, in hay and oats, the full produce of five acres of land. A man, allowing him a pound of bread, and a pound of meat a day, or in that proportion, does not consume quite an acre and a quarter; and as the poor eat but very little meat, it cannot be put at more than an acre to them; so that one of these horses eats nearly as much as five men.

16. *On the Preservation of Asparagus*[*].

In the month of April, the heads of Asparagus are frequently destroyed, in one night, by frost. My method is to cover the beds with old matting, which may be occasionally removed in the day time when the sun makes its appearance. I sometimes bestow upon the beds a gentle watering, when the season happens to be very dry, and I think with advantage. The same method may be pursued for the preservation of the tender tops of early potatoes.

17. *On Paring and Burning*[†].

Instead of the land being injured by the operation, as some theorists imagine, provided it be under a proper system of management and fairly dealt by, it is put into a progreſsive state of improvement, from the time of its surface being burnt. It has frequently happened, that land, after paring and burning, has been sown with corn four or five years in succeſsion, without being folded with sheep, or any part of its produce ever returned in manure; even charlock and other weeds have been suffered to remain, by which it has been annually burdened with a double crop; hence it has been left in an impoverished state, and the burning has unjustly been condemned for the mischief done by the negligence and rapacity of the cultivator.

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[*] By A. Hunter, M. D.

[†] By Mr. John Boyes.

Let the land, when burnt, be perfectly cleaned from charlock and other weeds, by growing turnips until the weeds are totally eradicated by hoeing, &c. Let the turnips be fed off the land by sheep lying on the land day and night; then sow it with barley and clover; the latter to be fed off with sheep, folding them on the land for wheat. Lastly, return the straw produced upon the land in manure mixed with clay or loam, or any other fresh earth that is near at hand, for a second Norfolk rotation, which may be repeated;

or the land may be sown with sainfoin, to remain till a turf is formed for paring and burning again, if thought proper. This plan being pursued, the practice of burning the soil will not give any cause of complaint either to landlord or tenant. Theorists exclaim, that by paring and burning, the staple of the land is reduced, and the soil wasted; this may somewhat be true; but all this is immaterial, if fine crops of corn can be produced where none grew before, and the land at the same time be improved.

The method of paring most in use, is with a downshare, or breast plough, taking off a turf as thick as the nature of the soil will admit, from half an inch to two inches; the thicker the better, provided there be a sufficient portion of vegetable matter contained within it to make it burn well; the expense for paring it of a moderate thicknefs, where the land is not very flinty, is 20 s. per acre; for laying it up in heaps and burning, 10 s. and for ſpreading the aſhes, 3 s. A coat of manure is thus produced on the land of from eighty to one hundred cart loads per acre, for the trifling expense of 33 s. A hundred cart loads of dung, purchased from the neighbouring towns and villages, at the distance of three miles from the land, would cost, carriage home included, ten times the price of paring and burning, and yet would not improve the land more.

Where the land is well covered with turf, it may be ploughed for burning, about two inches deep, with a common plough, drawn by a pair of horses, early in the spring; and as soon as a drying wind sets in, the turf may be laid in heaps, and burnt by labourers. It will produce near two hundred cart loads of ashes.

18. *On Sea Weed**.

In the Isle of Thanet, when a quantity of sea weed comes ashore, after a gale of wind, the farmers set all hands to work to get as much as poſsible while the tide serves, lest the next tide should carry it away; and if it happens in the night, they work at it till stopped by the waters coming in. Some farmers will get up, in one tide, two or three hundred cart loads. Those who live at a distance, hire small spots of land, of a few perches, to lay the fresh weed upon as they get it; and carry it to their farms at a more convenient opportunity. It sometimes comes ashore in quantities that amount to several thousand cart loads; and perhaps all swept away by the next tide. This circumstance stimulates the industry of the farmer. The principal method of using the sea-weed is by mixing it in layers among the farm-yard dung in the mix-hills. It is of great use in helping to rot the dry part of dung carried out of the farm-yard in summer.

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* By Mr. Boyes.

19. *On English Opium**.

It is now known, beyond a doubt, that as good opium may be collected in this country from the papaver somniferum, as what comes from the East Indies. From 600 heads of that kind of poppy, I last year collected five drachms of pure opium, which made eight ounces of tincture, equal in quality to what is made from foreign opium. The method of collecting opium is well described by Mr. Jones in the 18th Volume of the Transactions of the Society of Arts. The high price of opium seems to have encouraged the adulteration of it in the country where it is collected; a circumstance of serious consideration in the case of a medicine that requires to be dosed out with great exactneſs. The poppy being an annual and hardy plant, it requires no care beyond garden culture; and as the collection of the opium is performed by women and children, I make no doubt but that this drug may be profitably attended to in any part of Great Britain.

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* By A. Hunter, M. D.

20. *On Sowing Turnips among Beans**.

It is a custom very frequently practiſed in Kent, to sow turnips among drilled beans in April, and if the land be in good heart, they often produce a crop worth the hoeing, when the beans are carried off the ground in September; or if not, the farmer will be poſseſsed of some sheep-feed in the autumn, when it may be much wanted, and that at a trifling expense: the same field may be sown with wheat when the turnips are fed off, with this additional advantage, that the ground will have been improved by the dung and stale of the sheep.

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* By Mr. John Banister.

21. *Improvement of three hundred and twenty-five Acres of* Moor Land, *lying in Westmoreland*[*].

This land in its natural state was let from eighteenpence to two shillings per acre. The soil, a light mould, from five to seven inches deep; the substratum, a strong yellow clay; the natural produce, a strong benty graſs, mixed with a stunted ling. The whole divided into twenty-one fields, from ten to nineteen acres, planted with white thorn.

Number 1 and 2.—About thirteen acres each, were pared and burned in 1778, the ashes spread, and ploughed lightly in, and well harrowed and sown from the 1st to the 8th of August, with two bushels of clean-dreſsed hay-seeds, and three pounds each of red clover, white clover, and hop clover, and four pounds of rib-graſs to an acre. The seeds flourished during a severe winter, and both fields were mowed the following year, and produced a very luxuriant crop, computed at near two tons per acre; the second year they were again mowed, and the produce about two-thirds of the former year, but equal in value, the hay being much finer. The fog, or after-graſs, was ploughed in, to tender and meliorate the stubborn furrow by the winter's froſt, and in the ſpring ſown with oats. The crop tolerable; ſomething more than thirty Winchester buſhels per acre.

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[*] By Matthew Stephenson, Esq.

The ſtubble was ploughed in ſhallow, before the winter, and the land fallowed the next year (the fourth) and limed with forty buſhels to an acre, and ſown on the 2d, 3d, and 4th of September, part with different kinds of wheat, and part with maslin: (which latter was the beſt:) This early ſowing was ſuppoſed to be the proper ſeaſon in a cold country, and this opinion was afterwards confirmed by repeated trials. In the ſpring (fifth year) clover and hay-ſeeds, as above, were ſown in the wheat, but rather more ribgraſs, which ſucceeded the beſt. The produce was greatly beyond my expectation; but the hardy cone wheat, rough eared, was the beſt of the wheat, yielding rather better than twenty-five buſhels per acre; the other wheats twenty-two buſhels on an average; and the maslin, twenty-eight buſhels. Sixth, ſeventh and eighth years, the graſs allowed to be very good, and generally considered as worth twenty shillings per acre.

NUMBER 3 AND 4.—Fourteen and seventeen acres were pared and burned in 1779. No. 3 was sown with turnips, which were small, the seed lying in the ground five weeks without rain. Second year oats, very indifferent; this confirmed an opinion, that in this soil there is a faintneſs at first breaking up, which is injurious to corn. The third year fallowed and and limed forty bushels to an acre, and sown in the first week of September with cone wheat, and in the spring with graſs-seeds and clover as before. The crop of wheat was very good, paying at the low price of four shillings and sixpence per bushel, above six pounds per acre. 1783, 1784, 1785, continued in graſs, and then ploughed up again for corn.

NUMBER 4.—Seventeen acres were managed as Numbers 1 and 2. The season proving dry, the turfs were well burnt, and produced plenty of ashes; the land was sown down on the 6th and 7th of August, with twelve bushels of hay-seeds, two pounds each of red, white, and hop-clover, and six pounds of rib-graſs, (thriving the best, as before observed;) the crop was much better than Number 1 and 2; ninety-two two-horse cart loads were led out of the field, and made into a stack or rick, seventeen yards long, five yards broad, computed at forty ton, and produced of hay-seeds, near forty bushels per acre. The field was a very good pasture for four years, when most of the clover being worn out, it was ploughed up for oats. It will be unneceſsary to give a circumstantial account of all the other fields. The whole of the three hundred and twenty five acres are now in cultivation, and raised to four times their former value, being let at nine shillings per acre, on an improveable lease. Two complete farm-houses have been built, with all neceſsary conveniences, on this improved land.

The result of this improvement seems to be, that, beginning with hay-seeds and different sorts of clover sown on the ploughed-in ashes, is greatly the most profitable method. Whether paring and burning be generally a good practice, is with some people a doubtful matter; but these doubts probably arise from the subsequent management usually followed after this operation, in over-cropping the land for as to the idea of diminishing the soil, it is supposed to be erroneous, as the soil cannot be reduced by fire. However, it can scarce admit of a doubt, that paring and burning this benty coarse graſs, is the best and quickest method of reducing its tough sward, and preparing it for cultivation; when sown down with graſs-seeds on the ashes, my land never failed to produce great crops for three or four years. By following the above method, viz. first three years, graſs; next three years, two crops of corn, with an intermediate fallow, very profitable crops may be produced on land, by nature of little value.

No dung was used in this improvement, except on one field last year for wheat, for a trial; which, of courſe, had a good effect. The manure produced by the crops was applied to the improvement of the old inclosures, by which a double benefit was gained.

22. *On the Soil of Privies**.

Within these last four or five years, this manure has been spread upon my land at the expense of about one hundred pounds. The proportion from two to four loads per acre. The effect produced by it was *astonishing fertility*; so much so, as to induce me to be of opinion, that it exceeds every kind of manure that can be brought into competition with it; at least for the first year after it is laid on. In the second it is of some service, but in the third year its effects very nearly, or entirely, cease. From these premises I draw this conclusion; that, for land in good condition, the application of two loads per acre, per annum, will continue it in that state for any length of time; and also that land which has been much exhausted might be restored by laying on four or five loads per acre; after which, the repetition of two loads annually would be found sufficient to keep it in the highest degree of fertility. It appears to me, that nature, following her general system of reproduction, prepares this matter in the most perfect manner for the purpose of feeding vegetables, and raising them to the very highest pitch of excellence; and it is certain, that herbage growing under those circumstances, is capable of fattening the *largest* cattle in leſs time than any other.

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* By John Middleton, Eſq.

The importance of this kind of manure being so evident, it is to be lamented, that ninety-nine parts in every hundred of this valuable article is constantly and most *absurdly* carried off by the sewers and drains into the rivers, and thereby totally lost to the purposes of Agriculture, for which it is so admirably adapted.

In Britain alone, the quantity of this manure, and of urine, which is annually thus wasted, is astonishingly great; probably not leſs than five millions of cart-loads, worth to the farmers two millions and a half, and to the community five millions of pounds sterling, per annum.

23. *On Salt*[*].

It is pretty certain, that common salt is, on many occasions, agreeable to animals in a state of nature; nor is there much doubt, but that it may be often administered to domestic animals with succeſs: It probably acts in no other way, but as an agreeable condiment, that may prepare the body to receive the full effect of the food that is given along with it, help the digestion thereof, or make it be eaten with a more agreeable relish. In North America, there are found in many places, strata of earth impregnated with saline matter, which the deer and other wild animals discover of themselves; and to which they frequently resort to lick the saline earth with their tongues. If a hunter discovers one of these licks, as they are there called, he never fails to make profit ot it, by concealing himself near the place, and shooting the animals that come to gratify their palate with this agreeable refreshment. In Spain, and many parts of France, they give to their sheep a considerable quantity of salt, which they imagine both tends to fatten them and preserve them in good health; but it is said, they do not find it neceſsary where the ſheep feed upon chalky or limestone pastures. In England, it is well known, that animals fatten more quickly on salt marshes than any were else. From all these circumstances, it would seem probable, that common salt is, in general, an useful condiment, and might be employed on many occasions, with profit, in feeding domestic animals. Let it however be remembered, that salt acts as a poison when given to poultry.

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[*] By James Anderson, LL. D.

24. *On Fallowing**.

There is no question at all of the merit of fallowing, when compared with bad courses of crops. If the husbandry is not correct in this respect, the fallowist will certainly be a much better farmer than his neighbours. But there are courses which will clean the foulest land as well as any summer fallow. Cabbages are not planted before June or July: winter tares admit three months tillage, if tillage be wanted. Beans well cultivated, will preserve land clean, which has been cleared by cabbages. And in any case, two succeſsive hoeing crops are effectual in giving positive cleanneſs. These observations are not theory, they are practice: and it is high time, that mankind should be well convinced that the right quantity of cattle and sheep cannot be kept on a farm, if the fallows of the old system are not made to contribute to their support.

25. *On restoring worn-out Arable Land to Pasture*†.

The first step is to extirpate from the land all noxious weeds. This may be done by a complete winter and summer-fallow; or in place of the summer-fallow, by a crop of potatoes, well manured, and kept perfectly clean, and followed by winter vetches, fed off in the spring.

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* By A. Young, Esq.

† By John Billingsley, Esq.

At the latter end of May, or beginning of June, sow one bushel of buck-wheat per acre, and when that is up, and in rough leaf, harrow in (choosing, if poſsible, moist weather) two bushels of hay seeds collected from the best meadow hay, half a bushel of rye-graſs, four pounds of marl-graſs, and four pounds of white Dutch clover. The buck-wheat is chiefly intended as a screen to the graſs seeds. After the buck-wheat is harvested, which will be sometime in September, let the field be shut up for the winter, and let it be fed the next summer with sheep, or any kind of cattle, except horses, as the latter animal will tear up the young plants with his teeth. Should this pasture, in the course of three or four years, become coarse and rough, give it a top-dreſsing of lime mixed with pond or ditch earth, or any kind of compost. In a few years after this, give the land a good and complete covering of dung. By this method, a good permanent pasture may be obtained.

26. On *Milk*[*].

A cow, my property, produced at fourteen succeſsive milkings, 232 quarts, one pint and a gill, good measure. An exact statement of the quantity of each day's milk, is as below.

			Q.	p.	g.
1803, Feb.	16,	Wednesday evening	15	0	0
	17,	Thursday morning	17	1	0
		Evening	15	0	0
	18,	Friday morning	17	0	1
		Evening	16	0	1
	19,	Saturday morning	17	0	1
		Evening	16	0	0
	20,	Sunday morning	17	0	1
		Evening	17	1	1
	21,	Monday morning	18	0	1
		Evening	16	1	0
	22,	Tuesday morning	17	0	1
		Evening	16	1	0
	23,	Wednesday morning	15	0	0
			232	1	1

From this quantity of milk, fifteen pounds of butter were churned, which, at fifteen pence a pound, comes to eighteen shillings and nine pence, but if the milk had been disposed of at two pence a quart, it would have produced thirty-eight shillings and ninepence halfpenny. The cow is seven years old, and cost 25l. She calved on the ninth of January, and during the whole time of her milking, she was kept in the house upon turnips, carrots, bean-meal, bruised oats, and hay. The expense of her keep was estimated at two shillings and fourpence a day.

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[*] By the Rev. Mr. Percival.

At first sight, we might be led to suppose that the milk, if sold as milk, would have produced more money than when converted into butter; but when we take in the value of the skimmed milk, at one penny a quart, together with that of the butter-milk, we shall find the difference of profit to be very trifling in favour of milk. Besides, it will be but fair to charge the milk with the expense of carrying to market 232 quarts, instead of fifteen pounds of butter. So circumstanced, things may be considered as nearly upon a level.

27. *On the Culture of Beans**.

It is difficult to cultivate rich moist soils to full advantage, without the afsiſtance of this plant, which has two qualities of singular importance; first, that if extracting very little from the fertility of the soil; and a second, preparing better, perhaps, for wheat than any other crop. Where this husbandry is pursued, there can be no improvement more obvious than giving the dung to the beans and then taking the wheat. In the county of Kent, the beans are constantly dibbled in rows. I have found it more advantageous to plant in clusters, four or five beans in every hole, and eight or nine inches from hole to hole; this method admits of much better hoeing than when more thickly set. Where beans are properly cultivated, the horse and hand-hoe are constantly at work, as inceſsant cleaning is eſsential to this culture.

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* By A. Young, Esq.

The Kentish method of shimming the stubbles of beans, cannot be too much commended; whatever may have been the hoeing, there will remain some weeds; these ought not to be ploughed in, but cut shallow on the surface, harrowed out, burnt, or removed to the compost dunghill. By repeating this operation to absolute cleanneſs, the land is left in garden-order for wheat.

28. *On the difference between Winter and Spring Tares*[*].

Whether there subsists a difference between the winter and spring tare, is a question about which husbandmen are not unanimous. Some aſsert the distinction which is made between the two, real, and grounded in the nature of the plants themselves; whilst others conceive it imaginary, and to lie merely in the difference of seed time. With a view to decide this question, the following experiments were made.

Experiment 1.—Sept. 30, 1783, I sowed seeds of the winter tare and of the spring tare, near one another, in the same soil and exposure; and covered both with a coat of crumbled mould, one inch deep. The weather proving mild, the spring tare soon made its appearance, and two days after the winter tare came up. This ascendency it did not fail to maintain over the latter, until the middle of December; for at this time, it was about six inches high, and the other not above four. They both were in a vigorous and thriving condition, when a frost came on and continued for some weeks. When the thaw took place, I found the spring tare lying on the ground, slimy, and putrefied to the very root. The winter tare had received no damage; this grew up afterwards, and was ripe before the middle of August.

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[*] By the Rev. Mr. Laurence.

The circumstance of the different fates the plants experienced from the frost, led me into the fields to view the state of tares in a more open situation. There I found, that in some grounds, scarce any plants had failed; in others, were patches of something in a state of putrefaction, resembling the dead tares in my garden.

Experiment 2.—On the 6th of March, 1784, both sorts were sown in the manner above described; and in their springing up and growth, observed a progreſs similar to that which I had remarked in the autumn. Near a week later than the winter tare of the autumnal sowing, the spring tare of the vernal sowing arrived to perfect maturity. But the winter tare of the vernal sowing was mildewed, nor did a single pod of it ripen.

From these two circumstances, there appears a material difference in the constitution, if I may so call it, of the two tares in question. I shall say nothing to the trifling difference in the colour and size of their seeds, but paſs on to the visible marks I was able to trace in watching the proceſs of the two experiments. And this is a disparity in the first leaves of the upright stalks above. The leaves on the branches, which afterwards iſsue below, and in time form the bulk of the plants, resemble one another in the two vetches.

The purpose of curiosity thus far answered, let us see what may redound from these inquiries to the interests of agriculture. And here it requires no great degree of penetration in the husbandman to discover the neceſsity of keeping the seeds of the two tares separate and unmixed; since sown out of season, neither is found to prosper. Two bushels, or two and a half, are the portion of seed commonly allotted for an acre. September is the usual season for sowing winter tares; but continued by some through October. March and April for the spring sort. The best and most general application is for soiling.

29. *A Succedaneum for Turnips*[*].

As turnips are subject to rotting from frosts, I beg leave to recommend to sheep-masters, especially to those with breeding flocks, not to trust singly to them. I have found great advantage from having certain breadths of cole-seed, rye, and winter tares, sown early on the first stubbles that were cleared the preceding autumn; indeed, supposing no failures, it is absolutely neceſsary to have some provision for the couples, by the time the lambs begin to feed, as it will put them on a great deal faster than the best turnips that can be given.

30. *On preserving Turnips*[†].

To relieve the land from the very rapid vegetation of this root during the spring, I determined on the following treatment, the advantages of which I have experienced for many years, and which, with a few variations is, I believe, the general practice of the Suffolk farmers. About the middle of February, I begin to draw my turnips, cutting off the tap-root at the same time, and carry them to a pasture-field adjoining to my farm-yard, where they are unloaded, and labourers employed to take the roots, one by one, and set them upon the graſs, in as upright and close a manner as poſsible. I pursue this method through the month of March, until I have collected above a hundred loads; always availing myself of dry windy weather, when the tops are leſs brittle, and the roots in the cleanest state. The expense varies with the distance of carriage; the setting up, about three half pence per load of 40 bushels. The growth of the top is not much interrupted by the loſs of the tap-root, and is an ample compensation for the waste of the bulb. I carried about two loads per day to nine bullocks, which were confined in a farm-yard, with suitable binns; and do not recollect that I ever experienced so profitable an expenditure of my turnips.

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[*] By A. Young, Esq.

[†] By the Rev. Mr. Orbell.

31. *On applying refuse Potatoes to the feeding of [illegible] Calves**.

Take two gallons of small refuse potatoes, wash them clean, put them into a pot of boiling water sufficient to cover them, and let them boil till the whole becomes a pulp; then add more water, and run the whole through a hair sieve, which will produce a strong nutritive gruel. At first, use a very small quantity, warmed up with milk, to make it palatable to the calf, and increase the quantity daily, till it becomes equal. A quart of potatoe-gruel, and a quart of skimmed-milk, will be sufficient for a good meal, which should be given warm three times a day.

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* By Mr. Richardson.

12. *A Practical account of a Cottager's keeping a Cow on the produce of arable land only**.

For some years past, I have encouraged my cottagers in Yorkshire to manage their small garths, which are in general from one to three acres, in the Flemish manner, called about Fulham, the *field-gardening husbandry.* I here state the husbandry of a poor industrious cottager's garth. As the man can neither write nor read, I had these particulars from his own mouth; and as I saw his land almost every day during the last harvest, I can vouch that this account is not far from the truth.

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* By Sir Henry Vavasour, Bart.

Produce	*Value*					
	£.	*s.*	*d.*	*A.*	*R.*	*P.*
240 bushels of potatoes	24	0	0	0	2	0
60 ditto of carrots	6	0	0	0	1	0
5 quarters of oats, at 44s. per quarter	11	0	0	0	3	20
4 loads of clover, part in hay, and part cut green	12	0	0	1	0	10
Turnips	1	0	0	0	0	20
In garden stuff for the family, viz. beans, pease, cabbages, leeks, &c.	0	0	0	0	0	30
	54	0	0*	3	0	[illegible]

	£.	*s.*	*d.*
Deduct rent, including the house	9	0	0
——— seeds, &c.	3	0	0
Value of labour	10	0	0
	22	0	0
Produce before stated	54	0	0
	22	0	0
Profit if sold at market, exclusive of butter	32	0	0

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* These sums are conformable to the prices of this year, but it is evident that in other seasons they must in general be lower.

His stock was two cows and one pig; one of his cows had a summer's gate for twenty weeks with his landlord. The land was partly ploughed and partly dug with the spade; it was cultivated (the ploughing excepted) by the man, his wife, and a girl about twelve years of age, in their spare hours from their daily *hired* work, seldom a whole day off, except in harvest; made the rent in butter, besides a little used in the family. The man tells me that he thinks he clears one year with another, from the three acres, about £30: the daily wages earned by his family, about keeps them. It is very evident that this man clears from his three acres, more than a farmer can poſsibly lay by from more than eighty acres of land in the common husbandry of the country, paying for horses, servants, &c.; and it must be obvious to every one, how much the advantages must be to society in cultivating land in this manner. It would have taken more than half the quantity of his three acres in pasture for one cow at graſs during half the year; whereas (excepting the summer's gate for one of his cows, as before-mentioned) his stock of two cows and two pigs is kept and carried on the whole year. The family live well, and a handsome sum has been yearly saved to place out two sons, and supply them with clothes, washing, &c.

33. *On the support of latter Lambing Ewes*[*].

In countries where turnips are raised for the support of latter lambing ewes, it is not customary to begin sowing till the middle of July, and if that work be finished towards the first or second week in August, the farmers think they are in good time; for as their ewes do not usually lamb till the beginning of March, such turnips will by that time, if the latter part of the summer has turned out kindly for their growth, produce a large supply of wholesome and nutritious diet for the couples; whereas a field of forward turnips would be of little use, as not poſseſsing a degree of succulency neceſsary to furnish the ewes with milk.

34 *On Pease for feeding Swine*[†].

Although pease are much dearer than beans, they are, notwithstanding, to be preferred for feeding swine; it having been demonstrated by experience, that hogs do fatten more kindly when fed with this grain than on beans; and what is not easily to be accounted for, the flesh of swine which hath been fed on pease, will swell more in boiling, and be better tasted, than that which has been produced by beans; so that it has now become the practice with those farmers who are curious in their pork, to feed their hogs on pease and barley meal; and if they have no pease of their own growth, they rather choose to be at the expense of buying them, than suffer their hogs to eat beans. Nay so far do some of them carry their prejudice in this particular, as to reject the grey pease for this use, as bearing too near an affinity to the bean, and therefore reserve their growths of white pease solely for their hogs.

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[*] By Mr. J. Bannister.

[†] By Mr. J. Bannister.

35. *On the Leaves and Branches of the Scotch Fir for Sheep and Cattle**.

An advantage attending the culture of the fir is, that it has been found by some well-authenticated experiments, that the leaves and generality of farmers to sow their seed as thin as poſsible, and I have often heard them boast of their superior skill in this particular, by being able to cover an acre of land with a pound of seed. But this practice, besides the much greater hazard of the crop being destroyed by the fly, is liable to other objections, such as the poſsibility of the seed not being sown perfectly true, as the most expert seedsman is not able to guard against the contingency of the wind and other accidents, a failure in the growth of some part of the seed, &c. either of which circumstances will occasion the crop to be thin and irregular, whilst the field which hath had an allowance of three quarts per acre, will, if it were properly sown, be covered throughout with plants. This method is liable to one objection only, that I know of, and that is the hazard of a wet time that may prevent the plants from being set out so early as one could wish; consequently they will become more troublesome to the hoer than those where the seed had been more thinly sown. But this inconvenience may generally be obviated by harrowing the ground previous to sending in the hoers. This method of harrowing turnips in the early stage of their growth is a very judicious one, as it loosens the soil, and makes it work more kindly at the hoeing, which may succeed the harrowing at the interval of two or three days; besides, by that means the farmer gains time, if the turnips are likely to advance faster than the hoers can set them out, as the harrows at first do always give a check to the growth of the plants; and this is an advantage which cannot be so fully enjoyed by those fields which are thinly sown. To the benefits resulting from the liberal allowance of seed, may be added the obligation imposed upon the hoers, of cutting over the whole superficies of the ground, which they are very apt to neglect, and hence the field becomes crowded with barebind and other weeds, and the turnips not having the ground loosened about their roots, fail to push forward with that freedom and vigour, as they would have done, if the field had been properly hoed.

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* By James Anderson, L.L. D.

37. *On the Extirpation of Weeds* *.

A good farmer is known to pay a strict attention to the nature of the plants that grow in the margin of his ploughed lands and other waste corners of his farm. These places are often filled with docks, ragwort, thistles, and other uſeleſs or pernicious plants, which are often allowed to remain undisturbed till the seeds are brought to perfection, and dispersed by the wind through every corner of the farm, where they spring up in abundance, to the infinite prejudice of every useful crop, and the ruin of the farmer, whose attempts to clean and enrich his fields, are thus perpetually frustrated; for the richer and clearer his ground is, it is the fitter for rearing those pernicious weeds with the greater luxuriance. Every man, therefore, who hopes to be benefited by his labours, ought to be peculiarly attentive to see that every bad plant be cut down before it comes into flower, in every part of his farm. One thistle, or ragweed, that escapes in a neglected corner, may produce seeds sufficient to stock a whole field; and the seeds are so light, that they are dispersed to an amazing distance around; so it is of the utmost consequence that none of them escape the vigilance of the farmer. In this meritorious work, every farmer in the district ought heartily to join.

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* By James Anderson, L.L. D.

33. *The origin of feeding Oxen with Oil Cake*[*].

The use of oil-cake for fattening oxen owes its rise to accident, from whence many other valuable discoveries date their origin. About 20 years ago, some cakes, which is the substance remaining after the oil is preſsed out, had been flung on a meadow by the proprietor of a lineseed oil-mill for manure, the only purpose this refuse of the mill was at that time supposed capable of answering. In this meadow, some horned cattle were then feeding, and the graſs being short, they were tempted to taste of the cake, which after a few days proved so agreeable to their palates, that it was devoured by them with great avidity. It was not till a very material alteration was observable in their beasts, and that by the sleekneſs of their coats, they gave proof of being in a far better condition than the shortneſs of the pasture was likely to bring them, that the owners thought of examining into the cause of this sudden transition from leanneſs to the plump and sleek state at which they had arrived; when to their astonisment, they were convinced that the slighted oil-cake had worked this change; a circumstance which soon became known among the farmers, and was the origin of the present practice.

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[*] By Mr. J. Bannister.

39. *On Rape as a substitute for Turnips*[*].

When a turnip crop turns out deficient, and the season has elapsed for proceeding in the cultivation of that root, it may be advisable to sow the land with rape-seed, provided it be not of too light a nature. The leaves of this plant are of a deeper green than those of the turnip; and though this vegetable produces no edible root like the turnip, its stalks produce great store of succulent food for ewes and lambs in the spring.

40. *On the neceſsary encouragement to be given to small Farmers*[†].

There is not perhaps in Great Britain a more industrious set of men than the small and middling farmers; they toil inceſsantly from morning to night; they keep no stated hours, the whole family pull the same way: it is not so with hired servants; for them the sun rises too early and shines too long; their study is not to be useful to their masters, but to get their wages as easily as poſsible. The sons and daughters of a small farmer are rivetted as it were to home by affection and inclination. Though they work much harder, they consider themselves in a state superior to a hired servant, and therefore are contented and happy in their laborious situation, hoping to receive some advantages hereafter. It is a great pity that small farms cannot readily be had for the employment and comfortable subsistence of so deserving and so useful a set of people, who are too often forced from home to seek their bread in servile employments in great towns and cities, which circumstance frequently ends in the ruin of themselves, and in the certain depopulation of the country. Instead, therefore, of demolishing small farm houses, and erasing cottages, a practice proceeding from erroneous principles, let us daily increase their number, and let us give all poſsible encouragement to so worthy, and so industrious a body of people; whose well-being, and whose comfortable abode and residence, should be studied and encouraged by every land-owner, who regards the plenty, safety, and welfare of his country. I am aware that an objection will be raised on the ground of the heavy expense that must neceſsarily attend the constructing of so many small farm-houses, with their neceſsary buildings; but this objection loses its weight, when it is considered, that an estate of 1000l. a year, rented by one man, and in a country not highly cultivated, may reasonably, under a proper division, have its rental improved to 1400l. All that is neceſsary, is usefulneſs and convenience; all beyond is superfluous expense, and should be carefully avoided. The small farmers in the northern counties, who rent from thirty to sixty pounds a year, live happy and contented in houses covered with thatch, and built at a small expense. It is to the sons of these men that we must look up to in the hour of danger.

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[*] By Mr. Bannister.

[†] By A. Hunter, M. D.

41. *On summer and winter Food for Cattle*[*].

Common pasture graſs of course, is the great article that ranks under this first head. Winter tares mown, and used in the soiling way, are given to grazing beaſts for five or six weeks in the farm-yard, before turning to graſs, with great succeſs. By means of this practice, the pasture is made to go much further; and if the spring be cold and backward, it gets a head before turning in, and lasts much longer through a dry summer.

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[*] By Lord Kaims.

This practice is not confined to tares; lucern is still better, with the advantage of its lasting as long as it suits to use it.

In the article of winter-food lies the greatest difficulty of the grazier; and it is upon that on which his profit will depend more than on any other. Common summer feeding, which is to buy in, in April or May, and sell again at Michaelmas, yields very small profits, for meat is at that time always cheap; and the man who sells at the cheapest time of the year has a very doubtful point against him: if the beast is not at that time very prime meat, he will remain upon his hands. For which reason the intelligent grazier should contrive to sell when meat sells dearest; that is, from the first of March to the first of June; at that season he will not only make better than a halfpenny a pound, and sometimes a penny, more than in autumn, but his stock will go off freely, and the turn of every circumstance will be in his favour. This however he cannot do without much foresight in relation to winter-food: all will depend on his being well provided.

42. *On the Refuse of the Herring Oil-works*[*].

The neighbourhood of Gottenburg has lately experienced a wonderful improvement by the use of the refuse of the herring-oil works. Its stench, infinitely more offensive than night soil, does not deter the farmers from carrying it 50 or 60 miles in waggons. It is said that ten barrels, of 60 gallons each, is sufficient for one Swedish acre, after being diluted with a sufficient quantity of water. In all places where herrings or pilchards, are salted, much of this kind of manure may be obtained, and I apprehend that it may be had most plentifully at Yarmouth, and such places in Scotland, as prepare red herrings for sale. This composition differs in no respect from the refuse of whale blubber, which I fortunately recommended to public notice, about forty years ago, excepting in its containing a portion of sea-salt, which probably may increase its virtues by an increase of stimulus.

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[*] By A. Hunter, M. D.

43. *On the Seasons*[*].

The seasons are a mixture of regularity and chance. They are regular enough to authorise expectation, whilst their being, in a considerable degree, irregular, induces, on the part of the cultivators of the soil, a neceſsity for personal attendance, for activity, vigilance, and precaution. It is this neceſsity which creates farmers; which divides the profit of the soil between the owner and the occupier; which, by requiring expedients, by increasing employment, and by rewarding expenditure, promotes agricultural arts and agricultural life, of all modes of life the best, being the most conducive to health, to virtue, to enjoyment. I believe it to be found in fact, that where the soil is the most fruitful and the seasons the most constant, there the condition of the cultivators of the earth is the most depreſsed. Uncertainty, therefore, has its use even to those who sometimes complain of it the most. Seasons of scarcity themselves are not without their advantages. They call forth new exertions; they set contrivance and ingenuity at work; they give birth to improvements in agriculture and œconomy; they promote the investigation and management of public resources.

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[*] By W. Paley, D. D.

44. *On the situation of a Turnip Field*[*].

Turnips on land lying full to the south and morning sun, I have always observed, are the first to be destroyed by the frost; for as soon as the sun bears any power upon them, they get in part thawed, which happens very frequently; and they are as frequently frozen again till they become quite putrid. Land lying westerly, and inclining to the north, is leſs liable to this inconvenience. Land lying to the south, should always be sown, so as to be the first eaten off; for we may be aſsured, that they will be the first that are damaged by the frost. I do not remember ever seeing turnips obtained upon a pea-fallow, or upon a rey-etch (which of course must be late sown) hurt by the frost: on the contrary, they frequently are so sweet and good in the spring of the year, as to be the means of saving a fall of lambs, and also of preventing the neceſsity of feeding the young clover too soon.

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[*] By Mr. Arthur Tabrum.

45. *On Cottage Industry*[*].

A cottager who lives in the neighbourhood of a large town, and is poſseſsed of a correct and enterprising spirit, may be able to maintain a family by the produce of one or two small sows, as appears from the information of a respectable gentleman in the county of Nottingham[†].

The history of Britton Abbot, as given in the first Volume of these Eſsays, shows what may be done by a poor man, when once he has had the resolution to shake off that supineſs which is constantly observed in rustics of the lowest stations, of whom it may be truly said,——" vitam silentio transeunt veluti pecora." The following is the produce in number, weight, and value, of a small sow of the Chinese breed, between the first week in March, and the first week in December, 1802.

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[*] By A. Hunter, M. D.

[†] W. Walcott, Esq.

In the first week of March she farrowed 13 pigs—first litter:

	Weight.				
	st.	*lb.*	*£.*	*s.*	*d.*
5 killed as roasters	2	7	1	15	0
3 hogs killed in November	30	12	13	2	3
1 ditto still alive	12	0	5	2	0
4 sows now alive	28	0	10	8	0
	73	5	30	7	3

Second litter, farrowed September 26, 16 pigs, one of which died.

	Weight.				
	st.	*lb.*	*£.*	*s.*	*d.*
4 Pigs killed as roasters	2	0	1	8	0
11 ditto living December 1	28	0	9	18	0
4 litters from the young sows	15	0	10	10	0
	45	0	21	16	0
From above	73	5	30	7	3
	118	5	52	3	3

N. B. The original sow now in pig again.

☞ The hogs are valued at 8s. per stone—the pigs at 1s. per lb. weight.

46. *An Improved Method of Stall-feeding Oxen*[*].

In a room over the horse-wheel of my threshing machine, I have a complete corn mill with dreſsing machine, and two pair of mill-stones; the grey stones I appropriate to the use of my farm stock: on an average, these stones grind ten bushels in the hour with the same power that is used for threshing. A straw-cutter is worked from the tumbling shaft, or by hand; the quantity cut in a given time varies according to the length of the cut. With this machinery, I conceived that much advantage might be made of very trifling matters. For some time I ordered the whole of my light corn, spoutings,[†] and seeds of weeds to be laid up in the mill-room, keeping them as dry and sweet as poſsible. I had this refuse ground for the use of my feeding oxen, and with a common quantity of turnips I found my cattle to improve very fast. I have since added to the above-mentioned mixture a proportion of chopped straw, which has improved the quality as well as added to the quantity of the mixture. Here I must observe, that the chopped straw is mixed with the other articles before they are put into the mill hopper, so that by being ground together, the straw becomes like bran, and proves a good corrector of that aqueous plant the turnip. By this operation, the straw is so intimately mixed with the other ingredients, in the form of flour, that the cattle cannot separate one from the other, as is the case when straw is given in its cut state.

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[*] By H. J. Baines, Esq.

[†] Such grains as in consequence of their being firmly attached to the chaff, do not freely paſs through the riddles of the winnowing machine are called "Spoutings."

I prefer giving the mixture a little moistened, so as to prevent the breath of the oxen from blowing it out of the manger.

47. *Proportionate variations in prices betwixt the old nine Gallons, and Winchester measure*.*

The late regulations establishing the Winchester measure for corn and other grain, in place of the one before in common use, (containing nine gallons or thirty-six quarts to the bushel) seems likely to produce good effects, by fixing a general standard to which all may have recourse, and will probably prevent many mistakes which were likely to occur in the purchase or sale of grain, between people who live in different countries, and are in the habit of using different measures. Some inconveniences however have attended the introduction of this new standard. Men accustomed to buy or sell by the old measure, are not always prepared to accommodate to the new measure the prices they were to demand, or to pay; a circumstance liable to produce much confusion and loſs to one of the parties, as the two measures vary so much from each other as to make a considerable difference in the value of what is measured by them respectively.—In order to adjust this difference, I have drawn up the following Table, which explains the proportion of value in money, which a bushel of corn, or of grain of any kind, when measured by the nine gallon measure, bears to a bushel of the same corn, Winchester measure. On this subject it will be of use to explain a circumstance which has been frequently mistaken. It is commonly thought the Winchester bushel contains eight gallons or thirty-two quarts ale-measure, which is by no means the case.

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* By W. Falconer, M. D.

Some of our old statutes indeed, fixed it at this, as the act of the 12th Henry VII. c. 5. enacts, that a bushel shall contain eight gallons, and each gallon weigh eight pounds, Troy weight;—an excellent regulation, which it might have been prudent to have retained. The act of the 22 Car. II. ch. 8. sect. 2. recites, that the Winchester bushel, strucken even by the brim, contains eight gallons.—But an act of Parliament paſsed in the reign of King William, A. D. 1697, fixes the size of the Winchester bushel, by measurement of its diameter and depth only, by which it is ordered to be 18½ inches diameter, and eight inches deep round measure. The contents of a veſsel of these dimensions amount to 2150 cubical inches and 4152 decimal parts. If this sum be divided by 70.5. (the number of cubical inches in a quart) the quotient amounts to 30.5025. nearly, or a very small fraction more than 30 quarts and a pint; from which it appears, that those who have estimated it to contain 32 quarts have over-rated it by nearly an one-and-twentieth part.—I have not remarked that this circumstance has been noticed by those who have calculated the price of grain through a long series of years, as it ought to be considered as enhancing the nominal price of grain so measured, nearly in the proportion of an one-and-twentieth part ever since the dimensions of that bushel were so fixed and ascertained.

The Table following shows us the proportion which ought to take place, in point of value, of corn or other grain, when measured by the measure of nine gallons to the bushel, or by the Winchester measure; and is calculated from 2 shillings per bushel to 14 shillings and sixpence, advancing threepence each step. Let the reader find the price of corn or other grain in the column on his left hand, which is supposed to be the value of a bushel of corn or other grain, of nine gallons contents; and in the column opposite, and the corresponding line, will be found the price which a Winchester bushel, of the same corn should be sold for. The calculations are not all of them exactly true, but the difference seldom amounts to, and never exceeds, half a farthing in a bushel.—Those marked *p.* (for plus) are rather over-rated, and of course favourable to the seller; those marked *m* (for minus) are under-rated, and of course favourable to th buyer.

Meaſure of 9 gal. per bush. s.	d.	Winchester Measure. s.	d.		Measure of 9 gal. per bush. s.	d.	Winchester Measure. s.	d.		Measure of 9 gal. per bush. s.	d.	Winchester Measure. s.	d.	
2	0	1	8¼	m.	6	3	5	3½	m.	10	6	8	10¾	exact
2	3	1	10¾	m.	6	6	5	6½	m.	10	9	9	1¼	m.
2	6	2	1½	p.	6	9	5	8½	m.	11	0	9	3¾	m.
2	9	2	4	p.	7	0	5	11	m.	11	3	9	6¼	m.
3	0	2	6½	exact	7	3	6	1½	p.	11	6	9	8¾	m.
3	3	2	9	p.	7	6	6	4¼	exact	11	9	9	11½	p.
3	6	2	11½	p.	7	9	6	6¾	m.	12	0	10	2	exact
3	9	3	2	m.	8	0	6	9¼	m.	12	3	10	4½	p.
4	0	3	4¾	p.	8	3	6	11¾	m.	12	6	10	7	m.
4	3	3	7¼	p.	8	6	7	2½	p.	12	9	10	9¾	p.
4	6	3	9¾	exact	8	9	7	5	p.	13	0	11	0¼	m.
4	9	4	0¼	m.	9	0	7	7½	exact	13	3	11	2¾	p.
5	0	4	2¾	m.	9	3	7	10	p.	13	6	11	5¼	exact
5	3	4	5¼	m.	9	6	8	0½	m.	13	9	11	7¾	m.
5	6	4	8	p.	9	9	8	3	m.	14	0	11	10½	p.
5	9	4	10½	p.	10	0	8	5¼	m.	14	3	12	0¾	m.
6	0	5	1	exact	10	3	8	8¼	p.	14	6	12	3½	p.

ESSAY XXI.

On the Brown Tail Moth.

The caterpillar of the brown-tail moth, appeared so numerous a few years ago in the neighbourhood of London, as to occasion a general alarm. This insect stripped many kinds of trees and shrubs of their foliage and blossoms, but none were observed upon the herbaceous plants.

It may be remarked, in the first place, that the insect in question is not new in this country, being every year to be found in abundance, and well known to those who collect insects, to be the caterpillar of the Brown-tail Moth: nor is it peculiar to this country, but found in many parts of Europe, and has been mentioned by all who have written on it as noxious [illegible] Albin, an English writer on [illegible] us, that the caterpillars of this moth [illegible] themselves up in webs all winter, and as soon as the buds open, they come forth and [illegible]

under-rated, and of course favourable to th
buyer.

Measure of 9 gal. per bush. *s.*	*d.*	*Winchester Measure.* *s.*	*d.*	*Measure of 9 gal. per bush.* *s.*	*d.*	*Winchester Measure.* *s.*	*d.*	*Measure of 9 gal. per bush.* *s.*	*d.*	*Winchester Measure.* *s.*	*d.*
2	0	1	8¼ *m.*	6	3	5	3½ *m.*	10	6	8	10¾ *exact*
2	3	1	10¾ *m.*	6	6	5	6½ *m.*	10	9	9	1¼ *m.*
2	6	2	1½ *p.*	6	9	5	8½ *m.*	11	0	9	3¾ *m.*
2	9	2	4 *p.*	7	0	5	11 *m.*	11	3	9	6¼ *m.*
3	0	2	6½ *exact*	7	3	6	1¾ *p.*	11	6	9	8¾ *m.*
3	3	2	9 *p.*	7	6	6	4¼ *exact*	11	9	9	11½ *p.*
3	6	2	11½ *p.*	7	9	6	6½ *m.*	12	0	10	2 *exact*
3	9	3	2 *m.*	8	0	6	9¼ *m.*	12	3	10	4½ *p.*
4	0	3	4¾ *p.*	8	3	6	11¾ *m.*	12	6	10	7 *m.*
4	3	3	7¼ *p.*	8	6	7	2½ *p.*	12	9	10	9¾ *p.*
4	6	3	9¾ *exact*	8	9	7	5 *p.*	13	0	11	0¼ *m.*
4	9	4	0¼ *m.*	9	0	7	7½ *exact*	13	3	11	2¾ *p.*
5	0	4	2¾ *m.*	9	3	7	10 *p.*	13	6	11	5¼ *exact*
5	3	4	5¼ *m.*	9	6	8	0½ *m.*	13	9	11	7¾ *m.*
5	6	4	8 *p.*	9	9	8	3 *m.*	14	0	11	10½ *p.*
5	9	4	10½ *p.*	10	0	8	5½ *m.*	14	3	12	0¾ *m.*
6	0	5	1 *exact*	10	3	8	8¼ *p.*	14	6	12	3½ *p.*

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It may be remarked, in the first place, that the insect in question is not new in this country, being every year to be found in abundance, and well known to those who collect insects, to be the caterpillar of the Brown-tail Moth: nor is it peculiar to this country, but found in many parts of Europe, and has been considered, by all who have written on it, as notorious for its ravages. Albin, an English writer on insects, 1720, says, that the caterpillars of this moth lay themselves up in webs all winter, and as soon as the buds open, they come forth and devour to two or more sorts, as the *Phalæna Verbasci*, or *Water Betony Moth*, which appears to be equally fond of the *Mullein* and *Water Betony*: while others will devour indiscriminately almost every kind of herb, shrub, or tree, as the *Phalæna Antiqua*, or *Vapourer Moth*, which I have seen to thrive on the *deadly Nightshade* and *poisonous Laurel*.

The present Caterpillar is not so limited a feeder as some, nor so general a one as others. Its whole economy, however, shows it designed to feed on trees and shrubs, on which alone it is ever found. These afford it a support for its web, which is an habitation in many respects eſsential to its existence, and with which herbaceous plants cannot supply it.

We may, therefore, with as much propriety expect to see the *Cabbage Butterfly*, *Papilio Braſsicæ*, feed on our oaks and elms, as to find these Caterpillars destroying our herbs or graſs.

The following facts will serve to corroborate what is here advanced. They are found on the *hawthorn* most plentifully; on the *oak* the same; on the *elm* very plentifully; on most *fruit trees* the same; on the *blackthorn* plentifully; on the *rose trees* the same; on the *bramble* the same; on the *willow* and *poplar* scarce.——None have been noticed on the *elder*; the *walnut;* the *ash;* the *fir;* or on the *herbaceous plants.*

Thus it appears, that the only miſchiefs these Caterpillars are capable of occasioning, is to rob particular trees and shrubs of their foliage and bloſsoms: it remains to consider how far the trees and shrubs will be injured by such a loſs? and how far it may be injurious to their owners? I have found, by repeated observations, that those trees and shrubs which have been entirely stripped have not been killed thereby, but as soon as the Caterpillars have removed to change to chrysalis, they have put forth fresh foliage: the only loſs, therefore, the owner sustains from their depredations on those trees which are not cultivated for the sake of their fruit, is some check to their growth, and a temporary deprivation of the beauties of spring and autumn. With respect to fruit-trees, the injuries they sustain are more serious ones; as in destroying the bloſsoms, as yet in the bud, they also destroy the fruit in embryo: the owners of orchards and standard fruit-trees have therefore most reason to be alarmed.

The idea of their producing the plague, &c. is founded in the groſsest ignorance, and carries with it its own refutation; the health of the public is not, nor cannot be affected by them, either immediately or remotely.

Some persons have been alarmed least as they have now increased for three successive years, they should be infinitely more numerous the next. It may afford some satisfaction to those to be informed, that it is extremely probable, the trees and shrubs will not afford sufficient sustenance to the present accumulated brood; for should they be in the least stinted in their growth at the time of their changing to chrysalis, their wings will never expand, they will be incapable of flying, and of propagating their species. It is also extremely improbable, that the same circumstances should favour their increase another year.

What the actual causes are which occasionally produce these extraordinary quantities of insects will, perhaps, for ever remain among the arcana of nature. We frequently hear that, in certain parts of the country, much damage has been sustained by the *Cock Chafer (Scarabæus Melolontha)*; in others, that the turnips have been destroyed by a small Beetle, called the *Fly*; in others, that the same plant has been consumed by a Caterpillar of a *Tenthredo*; in others, that the wheat has been eaten in the ground by a small grub, producing an *Elater*, or *Spring Beetle*, One year the Aurelian shall find plenty of *painted Ladies (Papilio Cardui)*; another year, with all his care, he shall not find a single one. Last year the *Sphinx Convolvuli, Convolvulus Hawk Moth*, and *Papilio Hyale, clouded Yellow Butterfly*, were common about London; the naturalist may, perhaps, wait six years before he sees another.

The most probable causes are, the peculiarity of the weather, and the plenty or scarcity of the enemies of the Insect; for almost every different species of Insect has its peculiar enemy, and none more than the Caterpillars of Moths and Butterflies. As to the former, warm and dry weather are universally allowed to promote the generation of Insects; violent winds, heavy and long continued rains, or extreme cold, are, on the contrary, supposed to check and destroy them. It is, however, wonderful to observe, with what addreſs they secure themselves from the effects of the two former; such as feed on the boughs, on such occasions creep from them to the large branches or body of the tree, where they rest unshaken; and those who reside in webs are so secured as to suffer little injury from any of those causes.

We observed, that Caterpillars had many enemies. Birds of various kinds feed on them: the stomach of a cuckow that was shot, was found full of the Caterpillars of the *Buff-tip Moth (Ph. Bucephala).* Mr. Church, surgeon, of Islington, has observed birds very busily feeding on the Caterpillars of this very Moth, and carrying them to their young. The Ear-wig is a great destroyer of Caterpillars. But their grand enemy is the Ichneumon Fly *, a proof of whose destructive powers I experienced last year, in attempting to breed the *large garden white Butterfly*, *Papilio Braſsicæ.* Out of twenty Caterpillars taken from the Cabbage, eighteen were stung by this insect, and died. In proportion then as the insect's enemies are more or leſs numerous, so may be the insect itself.

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* There are various kinds of flies which pierce the skin, and deposit their eggs in the bodies of Caterpillars; but the most common is the *Ichneumon Fly*. The eggs thus laid quickly produce small maggots, which feed on the body of the Caterpillar, taking care to eat that part only

We shall now proceed to give a short account of the history of the insect which is the subject of this Eſsay; in the course of which, we shall

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which lies immediately under the skin, whereby they avoid injuring those parts which are eſsential to life; for, should the Caterpillar be destroyed, they also would perish. Till the period of their full growth arrives, the Caterpillar eats as usual, and appears equally well in health. That period arrived, which seldom happens till the Caterpillar has crept to some cenvenient place to chrysalize in, they eat their way out of its body, and immediately spin themselves small bags, or cases, in which they change to chrysalis. During this operation, which continues several days, the Caterpillar apparently suffers the greatest pain, and after struggling in vain with its mortal enemy dies. When the Ichneumon Fly is small, its maggots are proportionably numerous; a hundred of them frequently proceed from one Caterpillar. The little bags which they spin to chrysalize in, are frequently mistaken by the ignorant for the eggs of the Caterpillar.

point out what appears to us to be the best and most effectual method of destroying them. The Caterpillar, as already has been observed, owes its origin to a Moth, called the *Brown-tail Moth*, which is about two-thirds of the size of the Moth produced from the Silk-worm, and is of a white colour throughout, excepting a streak of brown on the under-side of each fore-wing, running near to, and parallel with, its anterior edge, and a brown or mouse-coloured tail, from whence it derives its name. These Moths come out of chrysalis about the beginning of July, at which time they may be found flying about slowly, especially in the evening, and depositing their eggs on the foliage of the trees and shrubs before mentioned. The female has a much larger tuft of down on its tail than the male, a great part of which is made use of in covering its eggs, which, when laid, look like small lumps of down on the leaves.

The young Caterpillars are hatched early in autumn; as soon as they quit the egg they set about spinning a web, and having formed a small one, they proceed to feed on the foliage, by eating the upper surface and fleshy part of the leaf, and leaving the under-side and ribs. It is curious to observe with what regularity they marshal themselves for this purpose. Thus they proceed daily, spinning and enlarging their web, to which they retreat every night and in bad weather, and extending their depredations. In the course of a few weeks their operations begin to be visible on the trees; their web as yet is not so conspicuous as those leaves, which, being stripped of their green part, aſsume a dead appearance: now is the time to destroy them, while their nest is small, and their ravages just conspicuous. They may be cut off the twigs or branches with a pruning-knife, or gardener's shears, whose handles may, if neceſsary, be lengthened; or by a sharp hook affixed to the end of a long pole. When cut off, they should be collected together and burned, merely to prevent their returning again to the trees and shrubs. By performing this operation thus early, you save the autumnal verdure of your foliage: if it be deferred till winter, the web will then be more conspicuous, and will have acquired a stronger and tougher texture, so as to bear pulling off, which should be preferred to pruning in certain cases, especially where it regards fruit-trees. No remedy short of removing the webs will avail. Lotions, fumigations, vermin powder, &c. will be applied to no purpose; they are too strongly enveloped to be affected by any of these. In about three weeks from their being first hatched, they change their skin, a proceſs which not only all Caterpillars undergo four or five times, at different periods of their growth, but also the *Spider*, the *Bed-Bug*, and even *Lobsters* and *Crabs*. This usually takes up several days. Afterwards, they proceed in the same manner, enlarging their web, and extending their daily foraging excursions, till benumbing winter confines them entirely to their silken habitation; they then not only secure the general web on all sides as strongly as they can, to exclude impertinent intruders, but each individual spins a thin case for itself: here they rest in a state of torpid security, till the genial warmth of the spring animates them afresh, and informs them, that the all-bountiful Author of Nature hath provided food convenient for them. Thus apprized, they iſsue forth in the day-time and in fine weather, as before; but having acquired stronger powers, and the foliage they have now to encounter being more tender, they become leſs scrupulous in their feeding, and devour the whole of it. A disposition to aſsociate continues with them til they have changed their last skins, when they usually separate, each endeavouring to provide in the best manner for itself. At this period they are most exposed to various enemies, and most frequntly attacked by the Ichneumon Fly. We sometimes find a few continuing together to the last, when each spins a separate web, in which it changes to chrysalis: this usually takes place about the beginning of June; here, in a state of perfect quietude, it remains about three weeks, when it changes to the Moth we have already described.

ESSAY XXII.

On the Elements.

WE can never think of the elements without reflecting upon the number of distinct uses which are consolidated in the same substance. The Air supplies the lungs, supports fire, conveys sound, reflects light, diffuses smells, gives rain, wafts ships, bears up birds. Water, beside maintaining its own inhabitants, is the universal nourisher of plants, and through them of terrestrial animals; is the basis of their juices and fluids; dilutes their food, quenches their thirst, floats their burthens. Fire warms, diſsolves, enlightens; is the great promoter of vegetation and life, if not neceſsary to the support of both.

We might enlarge, to almost any length we pleased, upon each of these uses; but it appears to me almost sufficient to state them.

AIR

Is eſsentially different from earth. There appears to be no neceſsity for an atmosphere's investing our globe; (the moon has none:) yet it does invest it; and we see how many, how various, and how important are the purposes which it answers to every order of animated, not to say of organized, beings, which are placed upon the terrestrial surface. I think that every one of these uses will be undersood upon the first mention of them, except it be that of reflecting light, which may be explained thus. If I had the power of seeing only by means of rays coming directly from the sun, whenever I turned my back upon the luminary, I should find myself in darkneſs. If I had the power of seeing by reflected light, yet by means only of light reflected from solid maſses, these maſses would shine, indeed, and glisten, but it would be in the dark. The hemisphere, the sky, the world, could only be illuminated, as it is illuminated, by the light of the sun being from all sides, and in every direction, reflected to the eye, by particles, as numerous, as thickly scattered, and as widely diffused, as are those of the air.

Another general quality of the atmosphere is, the power of evaporating fluids. The adjustment of this quality to our use is seen in its action upon the ſea. In the sea, water and salt are mixed together most intimately; yet the atmosphere raises the water, and leaves the salt. Pure and fresh as drops of rain deſcend, they are collected from brine. If evaporation be solution, (which seems to be probable,) then the air diſsolves the water and not the salt. Upon whatever it be founded, the distinction is critical; so much so, that when we attempt to imitate the proceſs by art, we must regulate our distillation with great care and nicety, or, together with the water, we get the bitterneſs, or, at least, the distastefulneſs of the marine substance: and, after all, it is owing to this original elective power in the air, that we can effect the separation which we wish, by any art or means whatever.

By evaporation, water is carried up into the air; by the converse of evaporation it falls down upon the earth. And how does it fall? Not by the clouds being all at once reconverted into water, and descending like a sheet; not in rushing down in columns from a spout; but in moderate drops, as from a cullender. Our watering-pots are made to imitate showers of rain. Yet, a priori, I should have thought either of the two former methods more likely to have taken place than the last.

By respiration, flame, putrefaction, air is rendered unfit for the support of animal life. By the constant operation of these corrupting principles, the whole atmosphere, if there were no restoring causes, would come at length to be deprived of its neceſsary degree of purity Some of these causes seem to have been discovered; and their efficacy ascertained by experiment. And so far as the discovery has proceeded, it opens to us a beautiful and a wonderful economy. Vegetation proves to be one of them. A sprig of mint, corked up ith a small portion of foul air placed in the ht, renders it again capable of supporting e or flame. Here therefore is a constant culation of benefits maintained between the o great provinces of organized nature. The ant purifies what the animal had poisoned; return, the contaminated air is more than dinarily nutritious to the plant. Agitation ith water turns out to be another of these storatives. The foulest air, shaken in a bottle ith water for a sufficient length of time, re- vers a great degree of its purity. Here en again, allowing for the scale upon which ature works, we see the salutary effects of orms and tempests. The yesty waves, which nfound the heaven and the sea, are doing e very thing which is done in the bottle. othing can be of greater importance to the ing creation, than the salubrity of their at- osphere. It ought to reconcile us, therefore, these agitations of the elements, of which e sometimes deplore the consequences, to ow, that they tend powerfully to restore to e air that purity, which so many causes are nstantly impairing.

WATER.

What ought not a little to be be admired, in water, are those negative qualities which constitute its purity. Had it been vinous, or oleaginous, or acid; had the sea been filled, or the rivers flowed, with wine or milk; fish, constituted as they are, must have died; plants, constituted as they are, would have withered; the lives of animals, which feed upon plants, must have perished. Its very insipidity, which is one of those negative qualities, renders it the best of all menstrua. Having no taste of its own, it becomes the sincere vehicle of every other. Had there been a taste in water, be it what it might, it would have infected every thing we ate or drank, with an importunate repetition of the same flavour.

Another thing in this element, not leſs to be admired, is the constant round which it travels; and by which, without suffering either adulteration or waste, it is continually offering itself to the wants of the habitable globe. From the sea are exhaled those vapours which form the clouds. These clouds descend in showers, which, penetrating into the crevices of the hills, supply springs. Which springs flow in little streams into the valleys; and, there uniting, become rivers. Which rivers, in return, feed the ocean. So there is an inceſsant circulation of the same fluid; and not one drop probably more or leſs now, than there was at the creation. A particle of water takes its departure from the surface of the sea, in order to fulfil certain important offices to the earth; and, having executed the service which was aſsigned to it, returns to the bosom which it left.

Some have thought that we have too much water upon the globe; the sea occupying above three quarters of its whole surface. But the expanse of ocean, immense as it is, may be no more than sufficient to fertilize the earth. Or, independently of this reason, I know not why the sea may not have as good a right to its place as the land. It may proportionably support as many inhabitants; minister to as large an aggregate of enjoyment. The land only affords a habitable surface; the sea is habitable to a great depth.

FIRE.

Of fire, we know that it diſsolves. The only idea probably which this term raises in the reader's mind was, that of fire melting metals, resins, and some other substances, fluxing ores, running glaſs, and aſsisting us in many of our operations, chymical or culinary. Now these are only uses of an occasional kind, and give us a very imperfect notion of what fire does for us. The grand importance of this diſsolving power, the great office indeed of fire in the economy of nature, is keeping things in a state of solution, that is to say, in a state of fluidity. Were it not for the presence of heat, or of a certain degree of it, all fluids would be frozen. The ocean itself would be a quarry of ice: universal nature stiff and dead.

We see, therefore, that the elements bear, not only a strict relation to the constitution of organized bodies, but a relation to each other. Water could not perform its office to the earth without air; nor exist, as water, without fire.

Of light, (whether we regard it as of the same substance with fire, or as a differen substance,) it is altogether superfluous to expatiate upon the use. No man disputes it. The observations, therefore, which I shall offer, respect that little which we seem t know of its constitution.

Light paſses from the sun to the earth in eleven minutes; a distance, which it would take a cannon ball twenty-five years, in going over. Nothing more need be said to show the velocity of light. Urged by such a velocity, with what force must its particles drive against, I will not say the eye, the tenderest of animal substances, but every substance, animate or inanimate, which stands in its way? it might seem to be a force sufficient to shatter to atoms the hardest bodies.

How then is this effect, the consequence of such prodigious velocity, guarded against? By a proportionable minuteneſs of the particles of which light is composed. It is impoſsible for the human mind to imagine to itself any thing so small as a particle of light. But this extreme exility, though difficult to conceive, it is easy to prove. A drop of tallow expended in the wick of a farthing candle, shall shed forth rays sufficient to fill a hemisphere of a mile diameter; and to fill it so full of these rays, that an aperture not larger than the pupil of an eye, wherever it be placed within the hemisphere, shall be sure to receive some of them. What floods of light are continually poured from the sun we cannot estimate; but the immensity of the sphere which is filled with its particles, even if it reached no further than the orbit of the earth, we can in some sort compute: and we have reason to believe, that, throughout this whole region, the particles of light lie, in latitude at least, near to one another. The spiſsitude of the sun's rays at the earth is such, that the number which falls upon a burning glaſs of an inch diameter, is sufficient, when concentrated, to set wood on fire.

The tenuity and the velocity of particles of light, as ascertained by separate observations, may be said to be proportioned to each other: both surpaſsing our utmost stretch of comprehension; but proportioned. And it is this proportion alone, which converts a tremendous element into a welcome viſitor.

It has been observed to me by a learned friend, that, if light had been made by a common artist, it would have been of one uniform colour: whereas, by its present composition, we have that variety of colours which is of such infinite use to us for the distinguishing of objects; which adds so much to the beauty of the earth, and augments the stock of our innocent pleasures.

With which may be joined another reflection, viz. that, considering light as compounded of rays of seven different colours, (of which there can be no doubt, because it can be resolved into these rays by simply paſsing it through a prism,) the constituent parts must be well mixed and blended together, to produce a fluid, so clear and colourleſs, as a beam of light is, when received from the sun.

ESSAY XXIII.

On the Management of Quickwood Hedges.

THE white-thorn has evidently been designed by nature as the best for making fences; not only to confine cattle within proper bounds, but for promoting warmth and protection to the fruits of the earth. It is particularly hardy in its own nature; it will force its way even in woods, and will bear transplanting at an advanced age. It is easily propagated for use by sowing its berries, and even the fibres of its roots will vegetate when cut into short lengths, and planted in the ground by the nursery-man. Whenever nature has designed any of her productions to be more than ordinarily useful to man, she has caused them to be more abundant, and to be more easily increased.

Although the white-thorn is easily propagated, is quick in its growth, and is an hardy plant, yet it requires the watchful care of the husbandman to keep it in order, and within due bounds. When it is suffered to run wild in hedge-rows without frequent pruning, it will readily ascend to its usual height as a tree. It will form strong stems, and the spreading branches of the top will soon overhang and destroy the lower shoots near the ground, on which depends the strength and usefulneſs of a hedge, where both are most wanted.

These lower, and certainly most useful branches of the white-thorn in hedges, are also too often destroyed by the injudicious practice of many farmers in embanking the produce of ditches, from time to time, against the stems of the quickwood, under the vulgar, yet mistaken notion, of keeping it warm. As often as time moulders down these high embankments, the mischief is discovered, and the hedge is seen entirely open at the bottom. This inconvenience might in a great measure be obviated, if the produce of the ditch, as often as it required to be cleared out, was thrown out on the side opposite to the hedge. This produce might be carted off at leisure, and compost heaps formed with it, intermixed with lime. After a year's incorporation, and being properly turned over during the time, these compost heaps would become an excellent top-dreſsing for meadow and pasture land, and amply reward the farmer for his labour.

The common method of renewing or cutting quickwood hedges, which is often performed by ignorant and injudicious workmen, is either by heading them down within three feet, or three feet and a half, from the ground; or by what is called laying, or splashing them. The first method is called, in many places, buck-heading; but it produces such an abundance of shoots from the top, that the lower branches are soon overhung, and consequently are destroyed. The other method of laying, or splashing hedges, is done by cutting down some of the upright stems of the quickwood in the rows to about the same height as in buck-heading, and leaving them at the distance of about two feet from each other, to serve as stakes. Most of the intermediate stems are then gashed half through near the bottom, somewhat reduced in the top, bent down, and wound among the stakes. The hedge thus laid, or splashed, is wattled at the top, and with the usual embankment from the adjoining ditch, is considered as completely renewed.

In the neighbourhood of Lincoln, and more particularly about South Carlton, the farmers vie with each other in the neat management and usefulneſs of their quickwood hedges. But to effect this, they pursue a different and more judicious plan. They not only make them an exceedingly strong, and in many instances almost an impenetrable fence, but also highly productive of fuel. Although they lay or splash their hedges, yet they do not embank against the roots of the quickwood, but car off the produce of their ditches, as often as becomes neceſsary to clear, and keep them open. They leave no upright stems in the rows to serve as stakes, but place common ones at the distance of a foot or eighteen inches from the rows. They then select as many of the slenderest stems in the rows, as, when gashed half through near the bottom, will lay down in a leaning direction, and interweave them with the stakes. All the rest of the upright stems are cut down within six or eight inches of the bottom, and the hedge wattled on the top,

The whole row of quickwood being thus freed from all impediments in its growth, will make strong and vigorous shoots, and in the course of seven or eight years will want renewing in the same manner, producing a great quantity of fuel at each cutting, equal to the expense of the labour. It will be neceſsary to give the hedge thus laid, or splashed, some defence, by means of hurdles, or sheep bars, for the first year or two, against the injuries of sheep and cattle; more particularly in meadow and pasture grounds, or in average-time in corn-fields. The hedges thus managed look particularly handsome, and become so thick at the bottom, that an open place is rarely to be met with.

ESSAY XXIV.

On Tithes.

AS the succeſs and improvement of agriculture is what every individual is greatly interested in, it is natural for all to wish to see every impediment to such improvement entirely removed out of the way. The present mode of paying tithes in kind, is, perhaps, the greatest obstacle that stands in the way of improvement. I do not mean here to inquire into the equity or legality of the parson's right to tithes, nor to accuse him of being avaricious or rapacious, as has been too often done; nor would I wish to excuse the occupier of lands, in any attempts to deprive the parson of what is acknowledged to be his legal dues. To the first I would recommend a becoming moderation: to the latter, integrity and punctuality becoming an honest man. By a due observation of these, peace and unanimity would take place of that unchristian rancour and uncharitable heat and rage, that reflects so much discredit on the parson and parishioners of some parishes; both being in the wrong, and both sufferers.

Let us take it for granted then, or rather let us allow, that the parson has a right to tithes in kind. We must not then call this an unjust appointment; but we may venture to say it is a very imprudent one. It is an imprudent one, because it has a direct tendency to discourage, and prevent all attempts to improve, where any extraordinary expense may be neceſsary, and the ſucceſs uncertain. Every one knows certainty in things untried, is to be acquired only by experiment. Experiments cannot be made without trouble and expense, and too often the experimentor is disappointed, to his loſs and vexation. But what adds to his misfortune and concern is, that although by his experiment he has lost, perhaps, to the amount of five pounds an acre, the amount of his produce, when set up in the field, is worth ten pounds an acre, and consequently by the present mode, the tithes amounts to one pound an acre, which before was only two shillings.

In this case, the parson is really benefited to the amount of eighteen shillings, out of the five pounds the farmer has totally lost. This is not only a poſsible case, but what much too frequently happens, though perhaps in different proportions. A farmer, therefore, who may have a strong propensity to advance the culture and improvement of his land, by more expensive manures and methods of cultivation, is forcibly intimidated, by the great additional loſs he sustains, if his experiments prove unsucceſsful, by so great a part being taken from him and given to the parson. It is extremely hard indeed, that the well-meant endeavours which injures one man, should in part be applied to enrich another.

This, in my opinion, is a national evil of so great importance, as to be worthy the consideration of the legislature. To recommend any measure that might leſsen the interest of the clergy, would be unjust; but if a mode could be hit upon, that would not suffer their interest to be diminished, and at the same time would secure to the person who might endeavour at improvement, the fruits and just reward of his labour, I should hope no candid, no fair man would object to it.

Let us inquire then if any such mode is practicable, and what such mode is. I clearly apprehend it may be easily effected, as thus; let the parson of each parish make out an account of the amount of the tithes received for twenty, or a competent number of years past, and from thence calculate the average amount, and let that sum, or any other beneficial sum, be an established *modus* for all future times. This would at once ascertain the parson's right, without diminishing his interest; leave the occupier of lands at liberty to pursue any schemes of management he might approve, free from apprehensions of being accountable to the parson for the same; and, finally, remove every foundation of that misunderstanding and ill-will, which too generally prevails in many parishes; not only to the vexation and discredit, but also to the mutual loſs of the minister and his parishioners.

It may poſsibly be objected, that this would not be doing the clergy justice, because it would deprive them of the chance they now have of their tithes being increased. To this I answer, if it deprives them of a chance of increasing their tithes, it secures them also against a poſsibility of their being diminished. It may be still said, the chance of its increasing, is greater than that of its being diminished. I answer, I hope it is; but certainly there is no injustice in the legislature's ascertaining a fixed sum, equal, or superior, to the average sum aforementioned, to be paid them in lieu of all tithes whatever, especially when the general interest of the public plainly seems to require it.

A tenth of the produce, though it is the clergyman's legal right, may, in many cases, be unjust. For where a grower of any commodity means well, and may take a great deal of trouble, and lay out a considerable sum of money with a view to make improvements; if he should happen to be mistaken, which is often the case, and sustain a great loſs by his experiment, would it not be cruelly unjust, to aggravate that loſs, by paying one-tenth of the produce for tithes, which would add greatly to the loſs already sustained.

Madder, when succeſsfully cultivated, is I believe, an advantageous crop; but I wi
venture to say, that many who have attempt

to raise it, have been sufferers thereby. Indeed all experiments and new practices are precarious and uncertain, as to their succeſs; they all require some, often a great deal, of labour, trouble, and expense; if they turn out advantageously, it it well for the experimentor, and will finally be so for the public. If, on the other hand, he is unsucceſsful, is not his misfortune sufficiently great, without subjecting him to the payment of a tenth part of a produce which may not even equal the expense of procuring it. If this is not repugnant to, and inconsistent with natural justice, and our plainest conception of the nature, reason, and fitneſs of things, then I have no proper idea of equity.

The present mode of payment is highly impolitic. Every individual, from the highest to the lowest, is materially interested in the improvement of agriculture. Improvement increases the quantity of produce, makes it plentier, and consequently cheaper; at the same time, it raises the value of land, and encourages exportation. Would any one then, who is a friend to his country, adopt a measure, and wish to continue it, which has a direct and obvious tendency to prevent, destroy, and counteract every attempt at improvement, the succeſs of which is attended with so much good to the public. Let us not then accuse the farmer of unreasonableneſs, perverseneſs, and obstinacy, for adhering to the cultivation of articles, the advantage of which his own experience has rendered certain; his refusing to adopt new articles, where the whole expense and risk are to be his own, and no certain benefit to be reaped but by the parson, surely is more deserving of applause than of censure.

The true state of the case then is, that the clergy have an undoubted legal right to a tenth part of the produce, and that the farmer cannot omit or neglect to set out the same, without a manifest breach of the law; that though they have a legal right, that right is often repugnant to natural justice, and the reason and fitneſs of things; and too frequently operates to the manifest loſs and injury of the public, in preventing useful and neceſsary attempts to improvement. A measure, therefore, that would secure to the clergy their rights, even to a fuller or more beneficial extent than they have ever enjoyed, and at the same time remove such formidable obstacles to improvement, would be a very desirable measure.

I cannot tell the reason, but in all the conversations I have had with the clergy, I find them averse to any compromise in regard to the abolition of tithes. A refusal so ill-grounded, and so obstinately persisted in, should be treated as it ought to be. Let Parliament fix the terms, and compel the acquiescence of the church. For a general good, a gentleman is compelled to sell part of his freehold land, though much against his will, for the formation of a canal or a turnpike-road; and how much more reasonable is it to expect parliamentary interference in a case that comprehends the morality, as well as the policy of the public.

That a rigorous exaction of tithes in kind has, in numerous instances, proved highly prejudicial to religion, no one in his senses can deny, but why those men who live by the altar should so resolutely resist a compromise, that in the end would strengthen the union that ought ever to subsist between the clergyman and his parishioners, is a thing that, in my opinion, cannot well be defended.

ESSAY XXV.

On Population.

A COUNTRY with a million of inhabitants that are strong and laborious, and also well inclined, being usefully employed, must increase fast in riches; a like number being added to them of the same abilities, and equally well employed, would doubly increase their strength, their security, and riches; but a like number being added, who might be quite destitute of their virtues, would be so far from increasing their riches and power, that they would in time render them impotent, poor, and wretched. So that numbers increasing may be a bleſsing or a curse, according as their powers are applied and directed; what is ascribed to population, of right belongs to industrious labour, care, and frugality. In the first case, their powers are united, and their riches and strength increase in proportion to the increase of numbers; in the latter, their powers act in a contrary di-

tion, and if equal, the last comers would de-
oy and annihilate the prosperity and hap-
ieſs of the former.

This appears in a stronger light in the gra-
tion of growing communities, who in their
ancy are bound by the strongest ties of ne-
ſity, to exert themselves unceasingly in the
ercise of the virtues above-mentioned, for
ir existence absolutely depends upon it;
s makes them flourishing and prosperous,
d their increase in number is owing to the
ne cause. Thus by indefatigable and pru-
nt frugality, they keep in a fast growing
te, until they become a great, a rich, and a
werful people. At length, intoxicated with
oyment, and forgetting by what means
y became what they are, ease, indolence,
d diſsipation poſseſs themselves of the va-
nt places from whence industry, labour, and
gality were banished; and the numbers on
ich they place their security, being mis-
ployed, only serve to hasten them on to a
te of poverty, misery, and sorrow.

Suppose a nation like Great Britain, had
sed itself by industrious labour, persevering
gality and fortitude, to such a pitch of glory

as to become respectable and formidable in the eyes of the world; blest with a fertile soil, a temperate climate, an industrious, ingenious, and brave people, well versed in agriculture, arts, and commerce, and sufficiently populous for every purpose; protected and defended by a numerous fleet, in the enjoyment of that native plenty our island does, or would produce to render us independent, and consummately happy. I say would one imagine that it was poſsible in the nature of things for a nation so distinguished, so eminently blest, ever to become weak, poor, defenceleſs and miserable? yet such sad events may happen. Though our number of people should decrease, we shall not suffer so much, nor feel the effects of depopulation so soon, as we shall the abuse and misapplication of those that remain. An indolent, and unemployed person, is a real political evil, and the state suffers by him just so much as he consumes; every person who is not employed about something, that is in some way or other useful or profitable, is in this sense an idle person, and the state is daily impoverishing by his means. To pursue this observation through all the degrees and employments of men, would be running a great length indeed; but without being particular, it is easy to see the unprofitable members of society in this kingdom, are out of all proportion greater than those upon whose labour, diligence, and industry they depend for bread; the natural and inevitable consequences of which are, an increase in the price of labour, a scarcity of neceſsary commodities, and consequently an increase of price in them; loſs of trade abroad, scarcity of money at home, nominal instead of real property; and the goods that filled the warehouses are now compendiously stowed away in account-books, never to be replaced, unleſs industry, frugality, and good economy, shall enable the debtors to wipe out their scores with honour. Thus an astonishing trade, that has long worn the face of prosperity and accumulated riches, stagnates, and at length expires in a long arrangement of figures; which, at the approach of time, with an hour-glaſs in one hand, and a moistened spunge in the other, vanishes away like a rarified vapour in the air.

But let us turn our eyes from a scene that fills us with horror and despair, and inquire if our condition is not still retrievable; and whether it is not poſsible that we may ſtill be a flourishing, a powerful, and a happy people.

From the above reasoning it appears clearly, that population alone can afford us no aſsistance, we must therefore have recourse to some more cogent means; what these are have been sufficiently pointed out, viz. Labour, Diligence, Industry, and Frugality. The difficulty is, how to prevail upon a people, who have been long accustomed to a life of idleneſs, extravagance, and diſsipation, to overcome its allurements, and to lead with steadineſs and perseverance a life of temperance, moderation, and virtue: This, indeed, is difficult, but absolutely neceſsary. Custom, fashion, and habit, are the sovereigns of the world; they fetter their vaſsals with chains of adamant, which require the utmost exertion of human power to knock off. To trace these baneful streams to the spring head, we shall find they rise among the great, the rich, and powerful; and from them are circulated through all degrees of people, from the highest to the lowest. But though their power is not to be overcome, their malignant nature may be changed by prudent measures.

Fashion, whose power is omnipotent, is nothing more than a servile imitation, propagated from the highest to the lowest. If her Grace chooses to give balls and expensive entertainments, her Ladyship must do the same; next Madam, &c. &c.; so that what was, perhaps, fit and proper in the beginning, by its motion downwards contracts a corroding quality, and by degrees eats away and destroys the substance it was intended to warm and cherish.

An example in the great operates so universally and so powerfully throughout the whole people, they may be said, so far, to be the presiding fate of the nation; by example, they can destroy or preserve the fortune of the people. May they, in compaſsion to a sinking people, set an example of prudent moderation, discourage the wear and use of every thing that is not the produce and manufacture of Great Britain, and may the legislature second their endeavours, by making extravagance, pride, vice, and luxury, bear the neceſsary expense of government. May the diligent and industrious be encouraged and countenanced, and may the idle and indolent be marked with infamy, and loſs of all credit and reputation. This would soon put a new and pleasing countenance on our affairs, and restore that peace and solid satisfaction, which nothing but the steady and constant practice of national and political virtue, can bestow and render permanent.

If we make gold and silver, and the goods and wares manufactured from them, the measure of the wealth of the nation, we are infinitely richer now, than we were too centuries ago; though nothing near so much so as we were but a few years back, witneſs the great decrease of foreign gold among us; and without a reformation in our manner of life and employment, we must be daily growing poorer. Gold and silver are not the produce of our island, they are therefore undeniable proofs, that our foreign trade, upon the whole, has been in our favour to the amount of the value of the gold and silver the nation is now poſsest of. We are still blest with equal powers and abilities, as when these riches were acquired; and the practice of the same discreet and prudent measures, will infallibly produce the same accumulation of wealth. But we must be careful to distinguish between a foreign and an inland trade.

it is by the first only our national wealth is increased. If the balance of that trade should in any year be ten millions, the nation would be actually ten millions richer than it was before; whereas, were the returns of an inland trade a thousand times that sum, the national riches would not be increased one shilling. Inland trade may be very useful and convenient, to circulate and divide our money among one another, for the common use and benefit of all; but, I am persuaded, upon a full examination it would appear, that many great undertakings, that employ great numbers of people, though it may be thought a bleſsing to the people employed, and a mark of goodneſs in the employer, yet eventually it may prove a very great loſs and injury to the public, and, poſsibly in the end, detrimental to themselves. Let us illustrate this by an example,

Let us suppose a gentleman, near some manuracturing town, has a mind to inclose fifty acres of land for a garden and pleasure-ground, but finds he cannot get the number of workmen he desires to carry on the work, unleſs he will advance their usual wages, which is ten shillings a week; he therefore gives notice that he will give eleven. At the same time trade happens to be brisk, and the manufacturers in the neighbourhood have large orders for exportation; however, seduced by higher wages, a hundred of their workmen desert them, and go to the gentleman, by which means they lose the sale of so much goods, as those men would have manufactured. Suppose their employment continues one year, the advantage to the workmen would amount to five pounds a week, or £ 260. in the year, which would certainly be deemed a very fortunate circumstance for them: But as this does not bring one penny into the nation, let us see then what it prevents the nation from receiving. The wages of a hundred men at ten shillings a week, would in one year amount to £ 2600. If they had continued with their former master, that is the sum they would have received; their masters the same of the merchants, and they again of the foreign customer; besides the manufacturers profit, the merchants profit, the labour of all other neceſsary workmen, and the materials of which the said goods would have been made, amounting together to a very large sum. A real loſs to such an amount the national stock would sustain by this transaction, though it wears the pleasing countenance of benignity, and, indeed, by no means proves any harm was designed, though it most certainly operates in this manner.

As opulence, and consequently luxury and elegance, spread and extend, we find works of advantage sacrificed to those of pride and ostentation; and that labour, diligence, and industry, which, if properly employed, would enrich the country, are now prostituted in raising monuments of folly and pernicious vanity. I would wish to be understood. Elegance and gentility have nothing criminal in their nature, when prudently timed, properly proportioned, and enjoyed with moderation and discretion; but whenever the taste and manners of a people become so exquisitely refined and extended, that so many labouring industrious people are therein employed, that the remaining number are not equal to works of use, and, indeed, real neceſsity, there cannot be a clearer proof of a fast declining state, nor a measure devised that would sooner effect its ruin.

All poſsible care then should be taken to encourage and promote our foreign trade; that should have a preference to every thing; inland trade and domestic luxury should never be suffered to stand in competition with it. We saw just now a hundred men buoyed up with false happineſs for a year, who by that short advantage lost the foreign demand, and are now destitute of employment, and of course wretched. The promoters, therefore, of elegance and refinement, are, sometimes, undesignedly the underminers and destroyers of the only foundation, upon which the glorious fabric of national riches and permanent happineſs can stand or be supported.

Let every one then who is ambitious of rendering service and duration to his country's happineſs, not only use his endeavour to promote and incourage industry among the people, but that sort of industry that will infallibly secure to them permanent riches and prosperity.

ESSAY XXVI.

On Large and Small Farms.

THIS is a subject of great national importance, and deserves a serious discuſsion. Suppose a gentleman poſseſsed of an estate of 1000l. a year, and that it consists of 4000 acres of land, all in the occupation of one opulent tenant, who pays his rent very punctually. This undoubtedly is a very agreeable circumstance, as the landlord has a certain dependance upon receiving 500l. twice a year. But this mode hardly allows of a poſsibility of advancing the value of his estate and of advancing his rent. At best, there are many chances that it falls, to one that it advances. Suppose the tenant by misfortune, or by profusion, or misconduct of any sort, should be obliged to quit his farm, very few tenants would be found who would be equal to such an undertaking. It is much but the misfortune of the former tenant would be ascribed to his paying too high a rent, and from thence an apparent powerful argument would be used to lower the same, to enable the next tenant to pay his rent and live. It is most likely this would be the case, as there would be few competitors. In an estate of 4000 acres, it is much but there would be many hundreds, which from their situation, and present circumstance, would not be worth more than a shilling or eighteen-pence an acre; perhaps are considered as absolute waste, being over-run with furze, fern, and broom; and serve no other purpose, but for a few sheep or young cattle to run upon during the summer months. A farmer who rents the whole, has neither leisure nor inclination to attend to the improvement of them: they are considered in his rent as nothing, and therefore all he gets from them is so much clear gain. I do not mean to reproach him for not improving such lands; I know it is neither for his interest, nor in his power to do it. His buſineſs is to make the most of those which are already under cultivation, those that are near his barton and farm-yard, which he can manure at little expense of carriage, and perform the whole buſineſs with the same proportionable ease. For where lands lie remote, as suppose at three or four miles distance from the farmer's habitation; the whole of the husbandry buſineſs is attended with a vast deal more expense, from the ploughing until the corn is got into the barn, than from such lands which lie near, or contiguous to it: besides, the advantages which daily accrue, by being constantly under the farmer's eye. Therefore, 1000l. a-year for such an estate so circumstanced, would probably be as much as a tenant could afford to pay.

Now let us consider this in a different way; instead of being in the occupation of one man, let us suppose it divided into ten, or which is perhaps better, into twenty farms; with a proper house and out-buildings to each. Each farm then, upon an average, would consist of 200 acres of land; upon the most convenient part of which the farm-house and out-buildings should be erected. The land of each farm should lie as well together as poſsible, yet should be so divided, that all the good land should not fall to one tenant's lot, and all the bad to another. Supposing the rent to continue the same, and being thus divided, the farms would probably run from forty to sixty pounds a-year, consequently would be inhabited by those, who might be called middling farmers, whose circumstances oblige them to be industrious; and, therefore, themselves and families would probably do the greatest part of the work.

Supposing the estate to be equally divided; then each tenant would occupy two hundred acres, and as each of them would live upon some part of his farm, each farm would have an equal chance of being properly cultivated and manured. Let us suppose one of these farms, out of the two hundred acres, contain one hundred and twenty that is properly arable land; and that the farmer should adopt the following course, as the most eligible, viz. to plough only forty acres each year, letting the other eighty acres be two years in artificial graſs. In that case four horses would be sufficient to do the work of his farm. The farm then would be thus divided, eighty acres of meadow and pasture, forty acres of corn, and eighty acres of artificial graſses. If in proceſs of time he finds his land will bear more tillage, he may then keep six horses, and will then have pasture sufficient to keep some scores of sheep, and to rear a pretty many young cattle, which of course he must fodder in his yard in the winter. He should likewise procure two or three good sows, and rear a score of hogs. His horses, cow cattle, and hogs, would together make a large quantity of dung, which being properly disposed upon his farm, would, with due culture, very soon improve the value of the same, to at least double what it was in its former condition: there is no mystery in this, the fact is self-evident. In the first case, a vast quantity of land lies rough and neglected; in the second, the farmer's situation is such, that he can cultivate and manure every acre, with great convenience and little comparative expense; and his interest strongly inclines him to it.

I, therefore, am clearly of opinion, that an estate circumstanced as above, though it may be worth no more than 1000l. per annum, if let to one tenant, would if divided and let to from ten to twenty tenants, be worth at least 1500l. per annum, and might certainly be made so much of without the least difficulty. An advance of 500l. per annum would certainly be worth the owner's consideration and attention. But there are other motives, besides those of self-interest, which plead strongly in behalf of dividing large estates, into farms of a moderate size; the absolutely neceſsary circumstance of peopling a country is greatly promoted thereby, and, therefore, as politically neceſsary as any one thing I know. This consideration is most shamefully neglected, even to such a degree, that if it was not for itinerant Irish and Welsh, at hay-making and harvest, many parts of the kingdom could not get in their crops in good season; indeed, notwithstanding all this adventitious aid, unleſs the harvest is remarkably fine, many people suffer great loſs for want of more help. It is a striking melancholy truth, that the number of our industrious, labouring people are daily decreasing, at the same time, the lazy, the indolent, and unworking, are daily increasing. The natural and unavoidable consequence of which is, an increase of the price of labour, an increase of the price of commodities of all kinds; and finally, the loſs of our foreign trade, the only poſsible means of increasing the wealth of a people. For where the price of labour is high, let it be owing to whatever cause you please, the price of commodities must be high in proportion thereto. If an Englishman must pay four or six times as much, for manufacturing a piece of linen or woollen cloth, as a French manufacturer does, it is absolutely impoſsible for an English merchant to sell at any market in the universe, where the French merchant is his rival. Should any man be the owner of a million of acres, without hands to cultivate them, and people to take off the produce, he would be neither the better nor richer for his extensive poſseſsions. And yet the prevailing taste is to add one farm to another, until many centre in one tenant. By which means one man is aggrandized, to the impoverishing, and sometimes to the ruin of perhaps twenty industrious families.

The middling and low claſs of farmers are the most industrious, pains-taking people in the kingdom; they and their whole families toil inceſsantly, and may be literally and truly said not only to earn their own bread by the sweat of their brows, but to provide bread and meat too for millions besides. Instead, therefore, of demolishing small farm-houses, and erasing cottages, an evil practice proceeding from the most erroneous principles, let us be daily increasing their number, and be giving all poſsible encouragement to so honest, so worthy, and so industrious a set of people; whose well being, and comfortable abode and residence, should be studied and encouraged by every land-owner who wishes well to his own interest, and the plenty, safety, and welfare of his country.

I am well aware it will be objected, the heavy expense that must neceſsarily attend the building of so many farm-houses, and other neceſsary buildings; but this objection is founded in error. All that is neceſsary, is usefulneſs and convenience, all beyond these is superfluous expense, and should be carefully avoided. Beauty and elegance in a farm-house of this claſs, are quite out of the question. Those that think them neceſsary, I apprehend must be strangers to most of the buildings occupied by farmers in the Western and Northern counties. They have no idea of a farmer, who rents from thirty to one hundred pounds, and upwards, per annum, living within mud walls covered with thatch; yet it is very true that they do, and as comfortably as any men in the kingdom. The walls are built of clay, or strong loam, tempered with water and mixed with straw. They first raise a foundation with rough stone, from two to three feet high, and about two feet thick; upon this they lay their clay mixture, making the wall rather thicker than the foundation. They carry them up from twelve to sixteen or eighteen feet high, letting it dry by degrees as they advance. By this means they make their walls proof against all weather. They are much warmer in winter, than either stone or brick, and cooler in summer. They are also very durable; there are many instances, I have been informed, of their standing above a hundred years; I have seen many above seventy years old, and would, I believe, stand as much longer, had the carpenter's work been properly done. For a brick building to stand so long, both materials and work must be better than they usually are at present. A little extra expense bestowed on the face of these buildings gives them a very decent look, and yet they are very cheap if compared with any other kind of building. The expense of a rod of work in length, and one foot high for workmanship, is one shilling, and for the materials the same. A farm-house forty feet in length, sixteen wide, and twelve high, would come to no more for walling than eight guineas; but suppose we recken ten, you see it is but a trifle. Such a building would be very sufficient for one of those farmers, as it would contain a kitchen twenty feet by sixteen; staircase six feet, and buttery behind it, and a parlour fourteen feet by sixteen. Suppose it fronts the south, at the east and west ends might be two lean-to's, or scalings, and the same the whole length to the north, which would afford room for a cellar, wash-house, milk-house, and wood-house, and three very convenient chambers. The ground-floors are commonly earth, or lime ash, or at best, paved with small stones; and as their houses are all thatched, the rafters and most of the small timber would be easily got off the estate, so that on this plan the neceſsary buildings for such a farm would be very moderate. An over-grown opulent farmer may laugh at such a dwelling for one of his brethren, though in a much lower sphere; but if his forefathers were in the same busineſs, it is, I believe, five to one, but they spent the best part of their days in some such like habitation, without thinking they had the least reason to repine at their lot.

But supposing the scheme of dividing such a farm should be attended with 1000l. extraordinary expense, (which I am clear it would not) the owner, surely, would have abundant recompense in advancing his rent at least 500l. per annum; besides the great satisfaction of contributing to the population, safety, and well-being of his country.

Another very great advantage would redound to the public, from this mode of practice, which I have not yet touched upon. A farmer who can occupy advantageously one of these large farms, must be a man of great property, and generally has it in his power to keep up his corn and other produce, until it will yield a price that pleases him: was this done only when prices were low, perhaps it would be an advantage to the public, as well as for his own interest. But experience has taught us, that the avarice of man is such, that as the commodities advance in price, so does the thirst of gain advance in the poſseſsor, and what should be a motive to induce the farmer to go to market, operates in a different way, and makes him resolve not to sell yet; hoping things will advance to such a height, as every one else shudders to think of. It is true these gentlemen dig a pit, into which they frequently fall themselves. We have numberleſs instances of their having kept their corn, until it would not yield them half what they might have sold it for before; and to their cost and sorrow, have sometimes kept it until it has been three parts in four destroyed by rats and mice. Was the loſs solely theirs, their neighbours would feel little regret; but unluckily whatever loſs is thus sustained, is a loſs to the public, as so much the leſs comes to their use.

Now matters are extremely different under the management of the middling and little farmer; they have not ability to hoard up and monopolize; their produce must come to market in the course of the year, and generally in regular succeſsion, as best suits their conveniency. The large and opulent farmer adds an artificial to a real scarcity, which increases the misery of the poor. The middling and little farmers act diametrically opposite, by relieving such distreſs as much as lies in their power, by their regular and well-timed supplies. Were it not for them the poor might be starved, when there is corn enough in the opulent farmers' hands to supply the whole people, until the next harvest might probably make it more plentiful.

From this view of things it most evidently appears, that the dividing large farms into several smaller, is a measure that has a direct tendency to improve the value of such estates; to render the neighbourhood more populous, to encourage farmers' sons, daughters, and servants to marry, to settle and rivet themselves, as it were, in their native countries, where their labour is absolutely necessary, for the support and well-being of the public. Gentlemen may fancy what they please, but they will most aſsuredly find in the end, that every measure that is taken to drive the poor labouring people from their parishes, is a most impolitic, as well as a barbarous practice. The industrious labouring people, constitute the wealth of every state; without them, millions of acres of fertile land, with its spontaneous produce, would amount to nothing more than what is enjoyed by the beast of the field. It is their labour that gives fruitfulneſs to the earth, and stamps a value upon every thing, which in its natural state has no value. If then their labour and industry are the true source of riches, how are they to be acquired, when they are driven out of the country?

The mischiefs arising from this cause are in their infancy, yet are sufficiently striking; and too plainly point out that they neceſsarily lead to depopulation and ruin. Many thousands are gone abroad; many more, both men and women, have been driven from the country, and have exchanged a life of honest labour, for a vicious one of sloth and ease. From hence comparative consumption is greatly increased, so is the price of labour and provisions; the consequence of which is a decaying foreign trade, the certain forerunner of a state of poverty and decline.

ESSAY XXVII.

On Carrots.

THE culture of carrots is one of the most interesting objects to be met with in the agriculture of Britain. It appears from Norden's Surveyors Dialogue, that carrots were commonly cultivated in the Sandlings of Suffolk, two hundred years ago, which is a remarkable fact, and shows how extremely local such practices long remain, and what ages are neceſsary thoroughly to spread them. For many years, (generally till about six or seven past) the principal object in the cultivation, was sending the carrots to London market by sea: but other parts of the kingdom having rivalled them in this supply, they have of late years been cultivated chiefly for feeding horses; and thus they now ascertain, by the common husbandry of a large district, that it will answer well to raise carrots for the mere object of the teams.

Not to enter very minutely into the cultivation, I shall note here, that the most approved method in Suffolk, is to leave a barley stubble (which followed turnips) through the winter, and, about Lady-day, to plough it by a double furrow as deep as may be, and harrow in 5 lb. of seed per acre. About Whitsuntide they hoe for the first time, thrice in all, at the expense of 18 s. an acre. The produce on good land, of 10 s. to 15 s. an acre, 400 to 500 bushels, but sometimes 800 are gained; on poorer soils, leſs; even to 200 bushels. They are left in the field during winter, and taken up as wanted; by which means, in severe winters, they suffer by the roots rotting, unleſs well covered by snow. In feeding, they give about eighty bushels a week to six horses, with plenty of chaff, but no corn; and, thus fed, they eat very little hay. Some farmers, as the carrots are not so good to Christmas as in the spring, give forty bushels and four of oats, a week, in the fore part of the winter; but in the spring eighty, and no corn. By long experience they find, that horses are never in such condition as on carrots, and will, on such food, go through all the work of the season better than on any other in common use; fed only with corn and hay, even with a great allowance, they would not be in near such order. If oats and carrots are given at the same time, they leave the oats and eat the carrots; but for horses that are rode fast, they are not equally proper. They begin to use them before Christmas, and continue it sometimes till Whitsuntide, those used in the latter part of the season being taken up and housed, to have the land clear for sowing barley.

There is scarcely an article of cultivation in any county of England, that more demands attention than this of carrots, for it is applicable to all sands, and dry friable sandy loams, of which immense tracts are found all over the kingdom, but this application of them is unknown. The subject is so important, that

I think it deserving the further attention of here adding the notes I took in a journey through Suffolk, the chief object of which was to ascertain the value and other circumstances of the crop.

Carrots Mr. Kirby has cultivated for some years; never leſs than four acres, and generally more. His culture is to sow them broadcast after clean barley or turnips, in order to leſsen the difficulty and expense of hoeing. He has tried them in drills fourteen inches asunder, but they would not do, and is clear they cannot be cultivated to advantage that way. He approves much of the crop by way of improving land, provided it is clean; but if foul, cannot be cleaned from spear graſs (couch) while under carrots.—He is decidedly of opinion, that they are not an exhausting crop; for, supposing them to be sown on one part of a field, and turnips on the other, neither part dunged, the turnips fed on the land, and the carrots carried off, as good barley will succeed the carrots as the turnips. But when he sows them after turnips, and then barley, he gets too coombs an acre more barley, than would be yielded if that crop was to follow turnips without the carrots intervening. All which is, upon the whole, very much in favour of the culture. The expense and produce as follow, on poor sand of 5 s. an acre:

	£.	s.	d.
One ploughing, deep,	0	7	0
Seed and sowing	0	4	6
Hoeing	1	1	0
Taking up, 1 s. a load of forty bushels topped, that is, on two hundred	0	5	0
Carting home	0	5	0
Rent, tythe, and rates	0	7	0
	£. 2	9	6

Produce.—Two hundred bushels per acre; but the value used at home not ascertained. The prime cost, at the above expense, is just three-pence a bushel.

Of all other applications, the most advantageous is that of fattening bullocks, in which he thinks them very profitable; has given them to his flock, and the ewes gave much milk; but the hardneſs of the root made them crones too soon, by breaking their mouths, on which account he left off that use of them. He kept eighteen horses a whole winter on carrots, with the common allowance of chaff and corn, substituting the carrots for hay.—That winter they ate only twelve tons of hay, whereas, in other winters, they ate forty tons: the saving was therefore twenty-eight tons, or above one ton and a half per horse. The allowance of oats was two bushels per horse per week. They were constantly worked, and never were in so good order.

The carrot husbandry of the Sandlings, (Suffolk) as they are termed, that is, the triangle of country formed by the three points of Woodbridge, Bawdsey-cliff, and Orford, I had been solicitous to gain a thorough knowledge of; the great importance of which I had first learned many years ago in this country: in my various tours through different parts of the kingdom, I had collected much information concerning them; but unfortunately opinions were so various as to the value of the crop, that the question remained undecided. About Woodbridge, they have been in the habit of selling the greatest part of their crops to the London markets, from which it has been conjectured, that the profit of the culture resulted not from the use of them in feeding their horses, but from the sale alone. Another point in dispute also arose concerning even that application: it has been contended that the utility is only when used in small quantities for the health, but not for the entire support of a team. These points are all of considerable importance; for it is in vain to recommend a great extension of the culture, if we cannot ascertain, beyond a shadow of doubt, the value of the crop when it is produced. In conversation on the subject, I had often quoted the practice of the Sandling farmers, but had of late been more than once aſsured that I had mistaken the matter; for those farmers, so far from trusting to carrots as an entire substitute for corn, were in the constant practice of giving oats at the same time. In all such disquisitions, I never, in one moment of my life, had any other object than that of ascertaining the truth: and, therefore, my only regret was, that of having viewed the country without sufficient attention; the moment was now come when I could repair that error, and, by a more minute examination, satisfy myself on a point so interesting to the national agriculture.

The first place we came to in this excursion, was Sutton, on the farm of Mr. Gerrard, where we received the following information:

that they ploughed for them but once, which was a double furrow as deep as poſsible; but Mr. Gerrard put them in on one very deep furrow, the plough drawn by three stout horses. They sow five pounds of seed per acre about Lady-day. Begin to hoe at Whitsuntide; three hoeings in all, at from 15s. to 18s. an acre. Ten loads (each 40 bushels topped clean) an acre upon good land, a middling crop; but upon walk-land (poor sheep-walks ploughed up) leſs. I was aſsured, by the workmen that hoed them, that Mr. Gerrard had once twenty loads an acre. I viewed his field this year of ten acres, which the hoers gueſsed at six or seven loads; they appeared to the eye to be about half a full crop. Last year Mr. Gerrard had seventeen acres which produced nine loads an acre; he sold an hundred loads clean roots to London, consequently he had fifty-three of refuse; that is, two-thirds saleable; the standing price 1l. 1s. a load. Respecting the use for horses—they are sold not uncommonly for that use at 15s. a load. In feeding, they give two loads a week to six horses, with plenty of chaff, without any corn; and that thus fed, they will eat very little hay. That the horses are never in such condition as on carrots; and will, upon such food, go through all the work of the season, being the best that can be given to a cart horse; but will not do for horses that are rode fast. They begin to feed with them before Christmas, and they continue it sometimes till Whitsuntide; those used in the latter part of the season being taken up and housed, to have the land clear for barley sowing. After carrots, they sow either pease or barley; both do well. The ten acred piece I saw, was a blowing sand, which they said would produce probably about two quarters an acre of barley; the course being, 1. carrots; 2. barley; 3. trefoil and ray graſs, two or three years; 4. pease, dibbled in with a frame; 5. rye.

Advanced next to Shottisham, where I viewed Mrs. Curtis's field of carrots, of eight acres, very fine. Sowed five pounds an acre on a double furrow; hoed thrice at 18s. The product gueſsed at six or seven loads; the average ten (each 40 bushels). More than half the crop is saleable. Last year many rotted on the ground; for their practice is to take them up as wanted, except having a store for their own use before hand, in case of frost. In feeding, they give six horses a load a week, and a coomb of corn; this, in the fore part of the winter, when they do not reckon them so good as they are in the spring; then two loads a week, and no corn; fed only on corn, even with a great allowance, they would not be in near such order; if oats and carrots are given at the same time, they leave the oats and eat the carrots. Till Lady-day they have straw, and after that hay, but eat very little of it, if they have a proper quantity of chaff with the carrots. They could be supported on chaff and carrots only, without either corn or hay, and would be as fat as moles.—The expreſsion used was, "That "the country could not be supported without "them; for they had not hay for such a "number of horses, if corn was the food, "as in other counties." This is not the only application; Mr. Linn fatted his bullocks last winter on them, late in the spring, to great profit. Others have tried it, and found that they do exceedingly well on them. Respecting the effect of the culture as a preparation for corn, they get very clean and good barley after them; but carrots must not be sown in land that is very foul. They choose a clean barley stubble; if the land is very full of weeds they are too difficult to hoe.

Proceeded to Ramsholt, where, on repeating our inquiries concerning carrots, we found that they sow five pounds of seed, at 1s. a pound, upon a double furrow fourteen inches deep, worth 7s. an acre; hoe thrice at 15s. to 21s. an acre. Take up at 14d. to 16d. a load, topping included. Mr. Weeden, on eighteen acres last year, had eight loads an acre nett for London, and two loads for himself; which crop is an average one. I viewed his field this year, it is nineteen acres, a regular and fine crop, without a weed to be seen. Barley is always sown after them, and is as good as that after turnips, though fed off, which they attribute to the depth of tillage bringing up old manure to the surface. In regard to the use in feeding horses, Mr. Weeden used carrots all last winter, and gave no oats, yet they never did better: five horses are allowed one load and a half (always forty bushels to the load) a week; they begin to feed after Christmas, and continue till the end of April: plenty of chaff is given, and the horses do not eat above half the hay they would do if they had no carrots. Mr. Weeden aſsured me, that if he was obliged to buy his horse-provender, he would purchase refuse carrots at 15s. a load, rather than oats, unleſs the latter were so low as 7s. a coomb, then part carrots and part oats. Mr. Bennington, at the Dock, would rather buy carrots at 15s. a load, than oats at 10s. a coomb; and carrots at 12s. rather than oats at 7s. Has found them also of admirable use for hogs.

Proceeded next to Alderton, where we found that Mr. Abblet had eight acres of carrots; but last year twenty. He thought that six horses should not have more than one load a week; one bushel per horse a day a proper allowance; but they keep the horses so fed in such health, that he thinks the saving of hay is not considerable. The food he should prefer would be both oats and carrots, one peck of oats to a bushel of roots. If he was forced to buy horse-food, he would prefer carrots at 15s. to oats at 10s. Culture and produce as before described.

Called next on Mr. Wimper, a gentleman-farmer of the same place, very sensible and intelligent, who obligingly informed us, that he generally gives oats to his horses as well as carrots; not because they would not do upon the roots and chaff, but because he has usually a greater stock of horses, &c. than breadth of carrots, and therefore he limits the use of them. If forced to buy his horse-food, he would prefer refuse carrots at 12s. to oats at 9s. Fortunately I put to this gentleman a question which I had before omitted: would you cultivate carrots if there was no sale for them? To which he replied, that he would undoubtedly have a few; as many as his consumption demanded; not only for his horses, but for his weanling calves, to whom he gave as many as they would eat; and also for pigs, and sows with pigs, in which application they are particularly useful. That calves must thrive greatly on them, I have not a doubt, for I saw many young cattle, oxen, and fat beasts of Mr. Wimper's breed, which were in every respect very noble beasts, and proved, from their age, how well they must have been fed when young.—Respecting the produce, the average on land of 10s. an acre, &c. is about nine or ten loads; and four or five on walk-land. The total expense of an acre about 3l. 3s.: if nine loads the crop, the prime cost is 7s. a load. Sometimes have seen as good barley after them, as after turnips fed; but it is not common.

From hence to Hollesley, where we repeated our inquiries; they choose the best land they have, which is the red soil; double furrow it fourteen inches deep; sow five or six pounds of seed at Lady-day, the price from 9d. to 18d.; hoe thrice at from 18s. to 21s. but if the land is very clean 16s. The common price of taking up, 1s. a load; sometimes up to 1s. 4d. topping included; it is done with spades. On good land, average produce ten or twelve loads; but on heath not more than five or six. Three-fourths of the crop nett roots for sale. As good barley after them as after fed turnips, but not always: generally good. In the application of the crop not sold, they give them to horses with plenty of chaff, but, in general no corn while on carrots; nor will they eat so much hay as if they were fed on oats: calculate the saving at more than a fourth. Some farmers give as many carrots as they will eat; but in general about two bushels each horse a day. The selling price 12s. to 14s. a load for the refuse roots.

Next we went to Capel St. Andrews. Mr. Groſs's great farm of 2700 acres, of whom, repeating our inquiries, we found, that he had been accustomed to cultivate carrots, even to last year, but his crops were so eaten up by the innumerable number of hares which his landlord, Lord Archibald Hamilton, preserved, that he has determined to sow no more. In these cases, the tenant, doubtleſs, has his recompense in the rent, but the public has none. The profuſion of game in this and another of his lordship's farms, Buttley Abbey, Mr. Chandler's, which are together above 5000 acres, puts a barrier to good husbandry, and prevents one of the best articles of culture in the kingdom from spreading. It is not only the hares that do the mischief, but their preservation nurses up a breed of rabbits which add to the evil. The reflection I have added is my own, and not the farmer's, who seemed very well inclined to second his landlord's wishes.

When Mr. Groſs did use carrots, he gave his horses each one bushel a day with chaff, but no oats; and aſsured me, that he had much rather feed on carrots than on oats; also, that they save more than half the hay; he has known his horses, after feeding on this root, refuse their hay entirely.

The culture of carrots was, some years ago, more common about Orford than at present; supposed to be owing to the great improvements in the sands near the Woodbridge river, which have rivalled them in the supply of the London market.

About Leiston are many carrots: few farmers of any consideration but have ten or twelve acres every year; they have however, a bad custom of continuing them on the same field for four or five years. The carrot culture improves the soil so much, that two years are the most they should be continued, by which means, the larger track receives the benefit; I have no doubt, from the situation of their consuming all themselves.

Paſsed over some poor land, commons and uninteresting husbandry, till we came to Wantesden; where, on making farther inquiries, we found that Mr. Curteen, of the Hall, has four acres of carrots for his own consumption only, giving them to his horses. Mr. Simpson was, for many years, on the same farm, and constantly in the same practice; always had a crop for his horses, and neither he nor Mr. Curteen ever sold a load to London. Here then we have found this clear fact: the intelligence was from a labourer that worked with Mr. Curteen; it was soon after confirmed by a neighbouring farmer, who said there were some others in the practice as well as Mr. Curteen.

It will not be improper here to review the several particulars we have gained. Without recurring to every article of the culture, it it will be sufficient to touch only upon the principal objects which have been the subject of doubt and disquisition.

At Sutton, six horses two loads a week; no corn; and eat little hay.

At Shottisham, six horses one load a week, with corn; in the spring two loads, without corn; eat little hay.

At Ramsholt, six horses seventy-two bushels a week; no oats; and half the hay saved.

At Alderton, six horses forty-two bushels a week; oats given; and saving of hay not considerable.

At Alderton, oats given because not carrots enough.

At Hollesley, six horses two loads a week; no corn; more than a fourth of the hay saved.

At Capel, six horses one load a week; no corn; save more than half the hay.

Upon reviewing these circumstances, it appears that two loads a week are a very large allowance, probably more than are neceſsary; seeing that with seventy-two bushels at one place, which is one and three quarters, and one load at another, all the corn is saved; let us therefore decide, that when six horses eat eighty bushels of carrots a week, which is thirteen bushels a week for one horse, they want no corn whatever, and will eat only half the hay of corn-fed ones. This will enable us to ascertain the value tolerably, though not exactly, because we do not know what would be the fair allowance of oats to balance such feeding with carrots. The whole turn of the intelligence ran upon the vast superiority of condition in which horses are kept by carrots, to that which is the result of corn-feeding, for this evident reason, carrots are given nearly, if not quite, in as large quantities as the horses will eat; but oats are never given in such a manner, they are always portioned out in an allowance very far short of such plenty. A quarter and a half of oats would, I am persuaded, from the general turn of every man's conversation, be inferior to two loads of carrots: this at 20s. is 1l. 10s.; there is to be added the saving of half the hay, which may be called ten pounds per horse a day, or seventy pounds per week, which, at 50s. a ton, is 1s. 4d. per horse, and 8s. for six; which, added to 1l. 10s. for corn, makes in all 1l. 18s. against eighty bushels, or 19s. a load: and that this is a moderate calculation, appears from the decided preference given by several farmers in favour of carrots at 15s. a load, against oats at 20s. a quarter, not reckoning the carrots by any arbitrary estimation, but supposing themselves forced to buy the one or the other.

The prime cost is calculated at 7s. a load; and that this is fair, will appear by the following articles:

	£.	s.	d.
Rent, tithe, and poor-rates	0	15	0
Ploughing	0	7	0
Harrowing, &c.	0	1	0
Seed, and sowing	0	6	0
Hoeing	0	18	0
Taking up ten loads, at 1s. 2d.	0	11	8
	£2	18	8

The tenth of which is 5s. 10d. or per bushel one penny three farthings; call it, however, 2d. per bushel, or 6s. 8d. per load; and if, to square with one article of intelligence, it is made 7s. it will not amount to twopence farthing the bushel. Here, therefore, another view opens upon us, which is the farmer's profit: the carrots are worth in feeding his team 15s. but they cost him only 7s. he has therefore the advantage of 8s. a load as the grower, on all his horses consume, and on an average 4l. an acre.

Another way by which a friend made his calculation, was this:

At one load and a half of carrots, nine loads a moderate acre, lasts six horses six weeks (N. B. He was inclined to think, from the intelligence, that one load and a half ought to be esteemed the proper quantity) and save six quarters of oats, which at 20s. is	£6	0	0
Three and a half cwt. of hay a week saved: 21 cwt. at 2s. 6d.	2	12	6
	£8	12	6
The carrots may cost	3	3	0
Farmer's profit per acre, by feeding horses	£5	9	6

It admits of various calculations; but view it in any light you please, the result is nearly, though not exactly, the same.

Two facts result most clearly from this in-have; to plough very deep; to hoe with great spirit; and to banish corn from their stables, as a mere luxury and barren expense that ought to be extirpated; an effect that flows very fairly, from the preference which the instinct of the four-footed inhabitant generally gives to carrots.

ESSAY XXVIII.

On the Atmosphere, considered as Nature's grand Repository of Manure.

THAT we should seek or expect manure from the air, will by many persons, be deemed a very chimerical hope. However fantastical this may appear, it is not leſs agreeable to reason, than confirmed by experience, that the atmosphere is replete with real material substances, which though too much subtilized and refined to become the direct objects of our senses, afford the true and genuine pabulum of plants, without which the whole vegetable kingdom would languish and finally decay and expire. From whence these substances originate, and how they are from time to time supplied, is, I conceive, a question of no very difficult solution.

It is a fact established by universal experience, that all animal and vegetable substances, when reduced by corruption and putrefaction, become the means of enriching and invigorating the earth, and of increasing its fertility. Of the amazing quantities of each of these substances, which are annually produced, a very small part returns to the earth in its original form of animal or vegetable substance. What then becomes of the rest? Not a grain of it is annihilated or lost. Upon a careful examination it would be found, that the solid parts of all animals and vegetables which descend to the earth, and by their gravity are fixed there, in their ultimate stage of dissolution and separation, bear but an extreme small proportion to the volatile parts, which are perpetually flying off, and mounting to their proper stations, appointed by their respective specific gravities. Observe any large animal body, (a whale if you please,) stretched out on the earth, and see what havock the intestine motion of its own juices, and the depredations of the elements, which are nature's working tools, will make upon it in the course of the summer. In little more than a twelvemonth, you will find scarce any thing remain, but the solid bones, and firm cartilages, which knit them together. This operation is abundantly accelerated when one animal becomes a prey to, and the food of others; for, from the experiments of Sanctorius and Dr. Keil, we are aſsured, that from a half to five-eights of all the aliment we take, flies off by insensible perspiration in the space of a few hours. Of the remainder which descends to the earth, little remains there long, but by a farther fermentation and putrefaction, a new sublimation takes place, and furnishes its quota towards replenishing the grand repository. Finally, if we pursue our inquiries until the bones, the most solid parts, are resolved into their original component parts, either by the slow operations of nature, or those accelerated by art, we shall find the atmosphere has got poſseſsion of the whole, except a most inconsiderable part of fixed earth, which seems to be the immutable substratum, or basis of all material existence.

Having shown that all animal substance in a state of diſsolution, becomes volatile and flies almost entirely away: let us next inquire what becomes of it then. Beyond the earth's attraction it cannot fly; nor can it continue to accumulate there; for in that case long ere this, the atmosphere must have been infinitely more dense than the earth itself. The truth is, what had been rarefied and volatilized by the heat of the sun, &c. in the day, is condensed by the cold of the night, and by that means becoming specifically heavier than the circumambient air, descends as copiously as it ascended before. This then is the treasure which the heavens bestow on the earth, to replenish, invigorate, and render it fruitful; which we receive by means of fertile showers, hail, snow, and dews.

But the great important question still remains,—how is the husbandman to avail himself of this boundleſs aerial treasure? All earths are more or leſs of an absorbent nature, except such which are of a close adhesive texture, and are already replete with moisture. Earth, in its natural compact state, is little suited to receive the beneficial returns of the atmosphere; if they are copious enough to form a stream, they run off as hastily as they fall; and if not, they are exhaled by the first clear sun or drying wind, leaving little or no improvement. Experience hath taught us, that those beneficial returns are made more copiously in winter than summer, especially if it happens to be frosty. The husbandman then is to prepare his land in good time, to receive all it can bestow, which is as much as the earth can suck up and retain. This is to be done by well ploughing his land as soon after harvest as buſineſs will permit, and if the land be strong, and turns up rough, it should be croſs-ploughed as soon as convenient, and left in that rough state of large lumps until the spring. Lying in such a state with so large a surface, exposed to all viciſſitudes of weather through the winter, the frost will have so thoroughly pervaded the clods, that if taken in a proper temper, they may be easily divided and broken into a competent fineneſs, imbued and replete with the rich and fertile principles of vegetation. But if the land in ploughing turns up of a shorter staple, and more friable nature, it should be presently croſs-ploughed, and laid up in very narrow single ridges. Being dragged acroſs the ridges after a few dry days early in the spring, it may be ploughed for the last time, and immediately planted or sown. In these preparatory winter-ploughings we should go as deep as the staple of the land will permit; for the more the earth is divided, the deeper will the nitrous air penetrate, and consequently the greater will be the quantity of fructifying principles deposited. This acquisition, great as it is, is far from being all the advantage that is to be reaped by the winter fallow; for the land will be fit to be cropped very early in the spring, which is attended with many and great advantages.

If I remember right, Mr. Tull, speaking of the great advantages of good ploughing, says, a little farmer having prepared his field for sowing, could not raise money enough to purchase the seed until he had lost the season; he therefore kept on ploughing at proper intervals until the next season, when he planted this field; at harvest his crop was so abundant that its value was more than sufficient to pay the fee-simple of the field. This, agreeably to his own theory, he imputed to the soils being thoroughly pulverized by reiterated ploughings.

The improving, or rather recovering land, to a degree of fertility by fallowing, is a practice of great antiquity. Whether the original practice was founded on any certain principles, is, I believe, not easy to be determined; but I never had yet any reason to think, that modern husbandmen followed the practice upon the genuine principles of nature. The general notion seems to have been that of letting the land lie to rest and recover itself, analagous to the rest neceſsary to animal bodies after hard labour, but how, or by what means the neceſsary principles were to be supplied, the generality of husbandmen seem to have had no idea; consequently could not, unleſs by accident, use the proper means to obtain the thing they so much wanted and desired. When letting lands lie fallow means unoccupied, that is neglected, it is the very reverse of improvement; fallowing without ploughing is rendering them unfertile, and multiplying labour and expense. On the other hand, I cannot estimate improvements by the number of ploughing; these depend upon being well performed, but more especially on being well timed; two or three ploughings will effect more, than four times the number at an improper season; that is, when the condition of the land renders it improper.

I cannot close this Eſsay without admiring the wisdom and goodneſs of Providence, in establishing the wonderful economy of nature, in making the animal and vegetable kingdom the reciprocal subsistence and support of each other. The animal may be said to be entirely supported by the vegetable; for though carnivorous animals eat no vegetable substances, unleſs for physic, yet they are but a remove or two from it, they living entirely on those that eat nothing else, as few of those voracious creatures, I think, eat one another, unleſs compelled by absolute neceſsity. On the other hand, we have shown the great support of the vegetable kingdom, is the sustenance it derives from animal substances, wonderfully prepared by the elaborate chymistry of nature. Thus by an unceasing revolution, both kingdoms are bountifully provided for, by means established by the great Author of Nature, the adorable object of our gratitude.

ESSAY XXIX.

On the Reproduction of the head of the Garden Snail, and of other parts of Animals.

THAT the learned and curious may the more readily be convinced of this admirable reproduction, it will be most useful to demonstrate, that the parts composing the new regenerated head are not in the least respect different from those of the old one cut off. But we are unable to accomplish this, until, with the aid of anatomy, we become acquainted with the parts constituting the head of the snail, which are much more numerous and complicated than at first sight could be credited.

When one of these reptiles extends as far as poſsible from the shell, it exhibits the whole neck and head. From the anterior part of the latter proceed the four horns, that is, the two larger above and the two smaller below. When completely elongated, each terminates in a globule; but in the larger is a black point, generally thought to be the eye. Immediately below the smaller horns, the lips appear; and when they open, while the animal feeds, the teeth are seen. All these parts, as well as the neck, are covered with minute glandular granuli, ſomewhat similar to those of a strawberry, or like shagreen. But this shagreen on the horns and lips is finer than on the head and neck. The under part of the ſnail is not shagreened; on the contrary, it is very smooth and slippery. Some naturalists call it the foot, and not improperly, from supporting the animal in its progreſsion. This is all that the eye can perceive: we are obliged to use the scalpel for penetrating the interior of the head, which is the object of our research. A snail cannot be diſsected alive: however much it is extended, it contracts entirely at the slightest touch, and retiring precipitately into its dwelling, lies in concealment there. On breaking the shell for examination, the head and horns are found retracted in such a manner within the body, as renders it extremely difficult to make observations on them conveniently. The easiest method to follow is that proposed by the great Swammerdam, in his excellent treatise on snails, which is killing them slowly in water: then they almost always remain with the head and neck extended from the shell, and the horns protruded. In such an advantageous situation, when the skin of the head is longitudinally divided with fine sharp sciſsars, there immediately appears the brain divided into two lobes; from the under part of which originates the medulla oblongata, and from above, the nerves: four are inserted in the four horns, and extend to the extremities; the other six divaricate to different parts of the body, as the muscles of the skin, the mouth, throat, and palate.

As far as I know, Swammerdam was the first who observed that the brain of the snail is moveable, and that its mobility arises from some muscles to which it is attached. By means of these it is drawn towards the fore part of the head, or is extended, according to the different motions of the body. When the animal stretches considerably from its shell, the brain is commonly situated above the œsophagus.

It has already been observed, that the black point at the extremity of the horns is commonly thought the eye; and such an opinion seems very reasonable. Indeed the singular ability of the often-named Dutch naturalist, and the aſsistance of powerful magnifiers, was able to discover the principal parts that characterize the organ of vision; the uvea, the three humours, and the arachnoid, investing the chrystalline lens. I have succeeded in sufficiently distinguishing all these parts, except the aqueous and vitreous humours, which it has never been in my power to discern clearly; but this I rather ascribe to my inability in examinations so minute, than to the non-existence of the parts. Of the four nerves, proceeding from the brain to the horns, two, which we shall denominate the optic, are attached to the eyes, and enlarge into a kind of gourd, or rather pear-shaped figure below. These nerves have muscles, by whose action, at the animal's pleasure, both large and small horns are retracted and concealed in the body; and the eyes, by this means, are also concealed, to be secure from external injury.

On removing the brain, the œsophagus is discovered, which is membranaceous, and furrowed by the finest longitudinal ridges of a livid ash colour. The sides are extremely smooth; and it contracts as it gradually approaches the mouth. This opening, by which the snail feeds, is provided above with a palate and a callous jaw, to which is firmly fixed a tooth of a corneous substance, chesnut coloured and shaped like a crescent, terminated by some sharp prominent points, which form, in a certain manner, so many most minute teeth, though, properly speaking, the animal has only one; and this is therefore the snail's only tooth. In the lower part of the mouth is the tongue, provided with a small kind of corneous substance at the extremity; and the root is fixed in a hollow semicircular cartilage. These are the chief parts of the head, omitting a number of muscles moving them: and as the description of these does not seem important, I shall neglect it altogether, without committing any fault by the omiſſion.

When I first discovered that snails regenerated the horns and severed head, several philosophers inquired what motives or reasons induced me to suppose these parts could be reproduced: and it is not improbable that the same question may occur to some other persons, to whom I shall briefly answer, as I have hitherto done. Previous to engaging with the reproductions of snails, I was en-ployed with those of earth-worms, concerning which there is a chapter in my *Prodromo sopra le Reproduzioni Animali*, and often had occasion to observe how much the reproduction was promoted, when protected from the injuries of the open air, by remaining covered in moist earth or dung. This very simple remark recalled to my memory the state of snails mutilated in certain parts of the body. I had seen them shut themselves up within their portable dwellings, closing the mouth with that viscous substance which exudes from the body, so that the air could with the greatest difficulty get acceſs. I then reflected, that a mutilated snail, retired within its shell, and shut up with the covering, was in a similar situation to decapitated earth-worms deposited in moistened earth. This rendered me desirous to examine whether the same would happen to snails as to worms; and my experiments began with cutting off the horns, which, every one knows, are an appurtenance of the head.

That the section of the horns may be complete, it is material they should be fully protruded from the head, which ensues when the snail stretches considerably from its shell; the whole four then being extended, they may be cut out by the root. If two are divided,—the larger for instance, the smaller are instantly retracted within the head, and the snail partly withdraws into its shell; but, in general, it soon appears, displaying the smaller horns. Hence, the experimentalist may cut off all four one by one, if he chooses. Though the animal is so mutilated, the head and neck are frequently protruded from the shell the same as when untouched.

A drop, and sometimes a little stream of transparent fluid, tending on cerulean colour, proceeds from the part where the sciſsars divide the horns; this arises from the rupture of the glandular substances. In examining the head, now deprived of horns, we discover four pointed trunks; the points being occasioned by corrugation and contraction of the root of the horn, where it has been cut. If we turn to the separated horns, which adhere to the sciſsars, we observe that, immediately after division, they swell, because they become considerably shorter. The skin, where divided, either corrugates so much that the plane of section is imperceptible, or it enlarges to cover the optic nerve and muscles.

moving the horns. The black eye continues visible at the extremity of the larger horns, after division; sometimes, however, it disappears, not but it remains in the separated horn: it is retracted and buried within, as diſsection proves.

The parts of several animals, we know, continue to move and live after separation, for a given time. Such is the case with scolopendræ, earth and water worms, cut in pieces; but particularly, the tails of lizards and water newts, which, for some time, will move, bend, and leap about, though cut into several parts. But quite the reverse ensues with an immense number of animals, so that the members, whenever separated from the body, lose all semblance of life and motion. Snails are akin to these. Scarcely are the horns cut off when they become motionleſs, or are only slightly convulsed for a few seconds. No symptoms of life are afterwards evident, when stimulated with a pointed instrument.

If the mutilated snails are examined in twenty or twenty-five days, it is not uncommon to find the rudiments of a reproducing horn. But this reproduction is very different from that observed in other animals; and here is one of those useful illustrations which teach us to distrust analogical reasoning. The famous Reaumur first showed, that the principle of reproduction, in the limbs of the fresh water cray-fish, began with a little cone in the centre of the trunk, whose base was infinitely smaller than that of the trunk, and, by the proceſs of time alone, became equal to it. A similar phenomenon has been observed by the celebrated Bonnet, in his earth and fresh water worms. The same appearances have been exhibited to me by the tadpoles of frogs, and by water newts, in reproducing the tail and limbs. The rays of sea-stars, whether casually destroyed by the bite of an animal, or cut off by men, protrude a little cone or tongue from the middle of the trunk, which is the expanding germ of the defective portion. And, in my voyage in the Mediterranean, during summer 1781, I saw several stars, that had lost the rays, budding these cones of different sizes; particularly, the *asterias rubens* of Linnæus; several of which I preserve in the great Museum of Natural History, in the University of Pavia. But the truncated horn of a snail does not advance in this manner. The trunk itself rounds into a little button of a blueish colour, which becomes larger and the colour darker; and at the summit, if we speak of the larger horns, is a prominent black point, which is the eye. The reproduced part continues extending, and, in a short time, the new horn equals in size its unmutilated fellow. In the same manner are the small horns reproduced.

If a half, third, or fourth part is cut off, instead of the whole horn, as has hitherto been supposed, reproduction equally takes place, in the like circumstances as we have mentioned. This is the more common course of nature in reproducing horns: sometimes, however, the trunk becomes long and pointed, instead of round. The point in time enlarges, and forms into a globule; the rest proceeds on as already related.

The snail makes the same use of the new horns as it did of the old, whether by protruding them from the head, extending, contracting, or concealing them, or by displaying their acute and lively sensibility; so that, on the most gentle touch, they are suddenly withdrawn and put in safety.

All these facts seemed to aſsure me, that the number of parts, constituting the divided part, would be exactly the same in the portion regenerated. But, wishing to ascertain the truth by the most minute anatomical examination, with a very fine iron instrument, I laid open several reproduced horns; however, I could not discover the smallest difference between the new and the old. The same skin, externally shagreened and within full of glandules, appeared; the same muscles moving the horns; the same nerves proceeding to their extremities, and their enlarging into an oval bulb; in short, the same parts composing the eye; therefore it would have been impoſsible to distinguish the new horns from the old, if I had not witneſsed their origin and increase, and if a slight contraction of the skin had not sometimes remained at the place from whence they began to shoot, or a little projecting eminence which marked the precise spot where the new horn had originated.

A sufficient degree of heat is eſsential to the succeſs of this reproduction. Temperate is not enough; and the heat must be at least 61°. Therefore, in Lombardy, and different parts of Italy, the experiment should be commenced in the beginning of spring. What I say of heat, respecting reparation of the horns, also applies to the head, of which I am about to treat. As the summer then approaches, the horns are quickly repaired. With regard to the time requisite for complete reproduction, two months in general suffice for whatever part of the horns is to be regenerated. It may also be remarked, that although the reproduction seldom fails, I have sometimes been unable to obtain it, notwithstanding the mutilated snails were kept whole years.

We have seen that the constituent parts of the snail's head are a shagreen skin, two lips, and two mandibles, with a lunar tooth fixed in the upper one: the tongue inserted into a semilunar cartilage, part of an œsophagus; the brain divided into two lobes, and sending forth ten nerves, besides four horns of different sizes. These practical remarks, however, are sufficient to ascertain that our experiments, on the decapitation of these reptiles, have been correctly executed. If all the various parts formed a head similar to that of most insects, I mean of a globular figure, or were comprehended in a part easily distinguished from the rest of the animal, one could at once see where it began and ended; consequently the exact place where the sciſsars or knife ought to be applied, would be known without any hazard of error. But the head of snails is otherwise constructed; when out of the shell, the body, if we omit the horns, is a rude figure of a cone, of leſs diameter before, and of greater behind, where confined by the opening of the shell. It is a certain fact the head exists in the anterior part of the cone, but the difficulty consists in ascertaining the precise portion which it occupies, that we may be sure how much it is safe to cut off. To acknowledge the truth, no absolute rule can be given, on account of the continual extension and contraction, the swelling and diminishing of the cone when the snail is in motion. I have commonly found, that the head extends from the obtuse extremity of the cone to about a line beyond the larger horns, when the snail stretches to the utmost from the shell, and there the section may be made so as securely to take away no more than the head. But if these limits be paſsed, so as to cut off some part of the body along with the head, then we are almost certain of the animal's death.

The snails on which my experiments have been made with the greatest succeſs are of three species; the *Helix pomatia, nemoralis,* and *lucorum,* to avail myself of the appellations of the nomenclator, Linnæus.

Having obtained reproduction of the horns, it occurred to me to examine what would ensue on severing the head; but apprehensive that the snails would die before repairing the whole, my experiments were begun with truncating a part only, which was that free of the larger horns, and comprehending the lips, the mandible, and tooth; the tongue and the two leſser horns; besides the muscular involucra, or integuments. This portion I shall hereafter call the *half-cut head,* for the sake of brevity. That the division may be properly completed, it is requisite for the snail to be fully extended, and the part then cut clean off with sciſsars, making the section perpendicular to the axis of the cone. But the operation has not uniformly succeeded according to my desire. The head of the snail, as already observed, is extremely sensible, and scarcely is the touch felt, when it suddenly contracts and retires: or, if it is extended, it turns about in various directions. Thence the section often fails of ſucceſs, if it is made obliquely, and the half head is not exactly ſevered. But as I judged it of the utmoſt importance, to the accuracy of the experiment, to learn what parts only were cut off, that it might be known whether the whole would afterwards be reproduced, ſhould ſuch a reproduction actually exiſt in nature, I impoſed a labour on myſelf, which I had not done in my experiments on the reproductions of other animals; and this was an anatomical examination of every half head immediately on ſeparation. I put the decapitated ſnails into ſo many ſmall veſſels, each numbered the ſame as in my journal, along with a brief anatomical deſcription of the parts of each divided head. Thus there was no danger of miſtake in my experiments; and I could alſo learn whether the parts repaired correſponded perfectly in figure and ſize to the parts cut off. After theſe remarks, which it is proper to make, we may paſs to the narrative of the reſults.

Immediately after amputation, the ſnail retires with the greateſt precipitation to conceal itſelf in the ſhell; and frequently, in the act of retiring, emits a gentle hiſſing, which ariſes from the difficulty which the air finds in escaping from the respiratory canal, that being in some measure contracted by the sudden contraction of the body. Notwithstanding this enormous wound, the snail sometimes soon afterwards comes out, and begins to crawl about in the same manner as when untouched; but the reverse generally happens. However there is a very easy method of forcing the snail out for the purpose of viewing and examining the wounds, which is, breaking a little of the shell behind with repeated gentle strokes of a key or the handle of a knife: the snail, irritated by the blows, appears in whatever degree of reproduction the head should be. To avoid useleſs repetition, I shall here observe, that such expedients have prevailed whenever the snail refused to appear, and gave me an opportunity of seeing the cut if lately made, or, indeed, the rudiments and progreſs of the reproducing heads. When the portion is cut off, some of that liquid, which in snails supplies the place of blood, escapes: it soon stems, because the trunk immediately begins to corrugate and diminish, so as almost to disappear; and in its place is observed a slight incavation, where no marks of the cut are visible. The snails thus decapitated for the most part fix to the veſsels containing them: they conceal themselves in their habitations, covering the mouth with their whitish operculum, produced by the tenacious matter which exudes from the body, and there they remain motionleſs for many weeks, or even for complete months.

When forced to come out, in thirty or forty days, the naked trunks of some appear without any marks of reproduction; but others, if the weather has been warm, exhibit a fleshy globule towards the middle of the trunk, very soft, and of a whitish ash colour, in which there is no organization, either without or within. However, in eight or ten days more, organization is sensible in the globe, then become much larger. The rudiments of the lips are evident, as also those of the small horns, the mouth, and tongue, and a membranaceous dark-coloured substance, which, from being fixed in the upper-jaw, and cutting through, shows it to be the regenerating tooth of the snail. These parts develope further, and grow more conspicuous; they succeſsively occupy greater space in the trunk; and, in two or three months at most, the divided head is repaired in such a manner, that, unleſs from the lighter colour, it is not distinguishable from the old one. This, besides external inspection, is demonstrated by anatomy. When the new head is laid open, the same parts are seen, corresponding in number, figure, and size, to those pre-existing in the old, which were scrupulously enumerated in my journal of each decollation. I cannot convey a more sensible idea of this reproduction to my readers, than by comparing it to an unexpanded flower. Considering the rudiments, they are a bud or little globe, consisting of membranes, so involved and aggregated among themselves, that we cannot discover the figure of the leaves, or petals, as they may be called. These petals gradually come into view, at first obscurely and confusedly, then so distinctly and evident, that every one may recognise them as the bud of a flower. In this manner does the involution of the expanding parts become visible in a real regenerated head.

This complete reproduction is very far from succeeding in all snails. Two most minute globules often proceed from the trunk, in one of which are the rudiments of the smaller horns: the other comprehends the rudiments of the lips, the mouth, tooth, and tongue. In proceſs of time, these globules are united together, forming one only, and, by further unfolding, constitute the half head. It is not unusual, that one of the two reproduced horns never attains the natural length, or is distorted, or that one lip is smaller than the other, or even that the new head is quite inclined to one side, or a hollow or contraction between the new and the old, or, in short, that the head is not repaired at all; and after six months, nay, after a whole year, the naked trunk alone appears, when the snail comes forth. When the cut is perpendicular to the axis of the cone, I have almost uniformly observed that reproduction has perfect succeſs, and that monstrosity and such anomalous productions frequently happen when the cut is oblique, and the bluntneſs of the sciſsars prevents the head from being at once divided.

I half decapitated three hundred and twenty-two snails at different times: the heads of one hundred and twenty-six were completely repaired. Thirty-one had different degrees of monstrosity or deformity. Fourteen had no reproduction, and the remainder perished*.

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* I discovered that half, as well as the whole head, would be reproduced during spring and summer 1766.

Thus I have learned, that cutting off only half of the head was fatal to most snails. All those that repaired the wanting portion, made the same use of it as of the old, as well in the numerous and singular motions peculiar to this part, as in taking the sustaining aliment, such as bread, lettuce, and the like; by which means, from being very much emaciated before reproducing the head, they acquired their original fleshy fulneſs.

I next determined to separate the head entire, and endeavoured to make the cut exactly in that place, and perpendicular to the fleshy cone formed by the head and neck. But the same difficulties are found here, as in amputating half the head, Thus the motion of the animals prevented the cut from always being made in the place intended. It has often failed, either from defect by separating leſs than the whole head, or from exceſs, by separating more. Therefore, that proper accuracy might be observed at every decapitation, I undertook the same anatomical examinations as before: the snails were preserved in veſsels appropriated for the purpose, as also an exact account of the parts they had lost by amputation. Four hundred and twenty-three were decapitated.

All those that, along with the head, had lost part of the neck, perished; nor is this surprising, considering that a portion of the organs of generation was likewise taken away. These organs originate within, on one side of the neck, and protrude by an opening when the animal copulates. A number mutilated of the whole head perished; but most of them survived this immense wound, and many completely reproduced the head. But as reproduction was attended by different circumstances, in various individuals, and all worthy of being known, it should be described in a more particular manner.

If a limb is cut off a water-newt, the head or tail from an earth-worm, the reproduction that ensues is an organized whole, that is, a limb, a head, or a tail, in miniature, perfectly similar to the severed one, and only requiring to be farther unfolded. On the contrary, no organized whole, comprehending all the parts of the severed head, appears on the trunk of a decapitated snail, but these parts are frequently separate from the beginning. Thus, some frequently expand after others; and only in a certain space are they all connected together, consolidated, and forming an organic whole, different in little or nothing from the old head. The subject will be more easily understood by examples.

Sometimes the incipent reproduction is a fleshy protuberance, adhering to the middle of the trunk by several points, and in a manner detached from it, which contains the rudiments of the two lips, the smaller horns, the mouth, tongue, and tooth, already repaired. The other parts, such as the larger horns and the rest of the head, are wanting altogether. The trunk of another snail will exhibit a large horn, already provided with its eye, and below, in a distant isolated part, are observed the first lineaments of the lips. In others, the reproduction is a groupe of three horns, two already of their natural size, and the third only a bit of skin. At first, some produce only a protuberance, which, by attentive examination, is discovered to be the lips involved and confined together. Some are already provided with a head complete, all except one or two horns. Lastly, the trunk will exhibit only the two large horns, or the small; or one large and one small.

But all these partial reproductions, and others that afterwards appear, join together in proceſs of time, and by their union form a single reproduction, which is the head, and this, in many snails, is not in the smallest degree different from the old one, except in the lighter colour; by means of which the least observant person can recognise the portion reproduced. In a little more time, the new head acquires the same hue as the old, and the one can be distinguished from the other only by an ash-coloured line, perpendicular to the axis of the neck, which faithfully indicates the place where the blade has paſsed in mutilating the snail. This is not constantly a simple line; sometimes it is a deep hollow, almost always of a whitish colour, perpendicular to the neck, if the cut has been perpendicular; and oblique, if the cut has been so. In the latter case, the incavation is frequently greater where most part of the head has been cut off: and, in some snails, an enormous wound appears on one side, though nothing is visible on the other, or only the ash-coloured line. And although length of time effaces the incavation, still the indication of the cut, that is, the line, will sometimes remain two years: nay, even after so long an interval, the head is not always complete, for it may want one or more horns; or these, at least the whole, have not attained the proper size, or are gibbous and monstrous. Such monstrosity having frequently occurred, I am inclined to suspect that it originates from the obliquity of the cut, or from being more or leſs advanced on the neck.

The most indubitable proof of regeneration seemed to be when the heads began to feed. However, I was desirous of convincing myself by the infallible aſsistance of anatomy, which has always demonstrated that the new heads, which externally seemed to be completely reproduced, were provided with all the constituent parts that I had found in the old heads, which, in each decapitation, had been enumerated to avoid doubts and errors. I may add further, that each new part united, and so exactly applied its most subtile fibres to the old, that we should never have known the snails were mutilated, had it not been indicated by the ash-coloured line surrounding the neck.

Here I should not neglect to observe, that, in the same manner as some snails, deprived of half the head, never reproduced even in the longest time, the like has equally happened to several of those totally decapitated. Indeed, of four hundred and twenty-three mutilated in this way, thirty-two did not evince the smallest rudiments of reproduction in a year; ninety-three could not reproduce better: the heads of one hundred and forty-five were regenerated with monstrosities; and the remainder died. Reproduction of the whole head requires nearly the same time as that of the half.

Should I be asked, why there is no reproduction, either of the head or horns, in different snails? I shall ingenuously confeſs myself unable to advance any thing concerning it but simple conjectures. As the reproducing and unreproducing snails are both of the same species, we cannot say that some of them have the property and others have it not. I should rather suppose, that the reproductive virtue cannot take effect from the diseased state of the snails; having uniformly observed, that, besides their most remarkable emaciation, the exterior aſsumes a yellowish hue, which seems the inseparable concomitant of snails affected by disease, and liable to perish.

After obtaining reproduction of the head, it was very natural to think that snails would regenerate other parts leſs eſsential; such, as the eminent collar which surrounds and ornaments the back of the animal, when out of the shell, and the flat broad foot by which it is supported during its motion. These two parts, when cut off, were repaired in the best poſsible manner; nature reproducing much or little, according as it had been cut away.

Uniting, in one point of view, what we have hitherto said of the reproductions of snails, it clearly appears; 1. That they can repair the horns, whether partially or wholly amputated; 2. The head, when half is cut off; 3. That it is as completely reproduced, though the whole has been severed; 4. Whatever part of the collar or foot is cut off, it is regenerated. From which it is evident, that these reptiles recover precisely the parts that they have lost. This is not peculiar to them, for it takes place in other reproducing animals. If a newt wants a third or fourth of the tail, only a third or a fourth is reproduced; and the same may be said of one half, or the whole tail. A similar phenomenon succeeds in the fore and hind legs of this amphibious animal. Reproduction of the parts wanting only, extends invariably to worms, as also to frogs, while yet tadpoles. Besides, on consulting the authors that have treated of animal reproductions, I find that the same unalterable laws have been observed; whence we may establish this general rule, if some anomalies are excepted, in animals, endowed with a reproductive property, nature produces no more than the parts or organs of which they have been deprived.

Hitherto three species of snails have been mentioned, *helix pomatia*, *nemoralis*, and *lucorum*. But are these the only snails enjoying reproductive powers? The experiments of foreign naturalists demonstrate that other species participate the same privilege. Yet I must acknowledge, that my experiments, on others have almost always been void of succeſs; for they have either not repaired the head or horns, or only exhibited the first rudiments of reproduction, which terminated with the death of the animal.

But whence does it arise that some species of snails have the faculty of reproduction, and others have not? Should such a question occur, I must candidly confeſs, that I have had not sufficient materials to explain it. Was the organic structure of the reproducing snails very different from those that do not reproduce, some reason might be aſsigned for it; or, to speak more philosophically, was there any disparity between them. However, no such thing was found, at least by me, with any certainty, among the various species of snails that either succeeded or did not succeed in reproducing.

This uniformity of organization in snails specifically different, which at the same time produces opposite results, as reproducing and not reproducing, is a useful leſson that we cannot avail ourselves of analogy in reasoning from one species to another; but that truth may be attained, we are under the neceſsity of undertaking as many experiments as there are animals specifically different; and the force of this conclusion, so humiliating to us, is more plain and evident, by throwing a transient glance on the various animals which naturalists have at different times discovered to be endowed with a reproductive virtue.

When the immortal Trembley first displayed the prodigies of the polypus to the philosophical world, it was thought that the very simple structure of the animal chiefly contributed to effect them. Indeed, the polypus being destitute of a heart, veins, and arteries, and, consequently, of the real circulation of fluids; neither brain, spinal marrow, or nerves, nor any other concomitant of these parts, which are met with in an infinity of animals, being found in it; but the whole appearing of a gelatinous and homogeneous substance, universally covered with a number of granules; all this, I say, excited belief, that the simplicity of structure concurred in marking the portion cut from the polypus become an entire polypus. Thus it was thought, before the Genevese philosopher's discovery, that the wonderful phenomena, afterwards seen in the polypi, succeeded in plants from their very simple structure. And the reproduction of parts lost by other animated beings of simple structure, as sea-nettles, sea-stars, and I may also add, crayfish, favoured the opinion. But it having afterwards been found, that certain fresh water worms, though much more compound than polypi, when cut in pieces, would become so many complete worms, it was demonstrated, that simplicity of organization was not a condition requisite for the reproduction of wanting parts. Besides, this is verified in the clearest manner by earth-worms, since Reaumur has found that, cut in pieces, they multiply like plants; which is a physiological fact that some naturalists have denied; but it will be put beyond all question in my *Riproduzioni Animali.* When I name the earth-worm, I speak of an animated being, whose organization is a thousand times more complicated than that of the polypus; from finding the circulation of blood, and, consequently, arterial and venous veſsels in it; an alimentary canal, spinal marrow and nerves, and the union of two sexes, as it is an hermaphrodite. Of the same complicated structure is my fresh water boat-worm; nevertheleſs its reproductive faculty is not inferior to that of the earth or fresh water-worm.

Yet how much higher does the organic structure of snails and newts place them in the animal scale? Let us omit the former, as enough has already been said of them, and stop a moment to consider the latter. Though naturalists have properly claſsed the water-newt among amphibia, it is a real quadruped, as it poſseſses in miniature most of the parts which quadrupeds have in large. A great number of these have the tail provided with osseous vertebræ insinuated into each other, and ſucceſsively smaller as the tail diminishes. The tail of water-newts is of the same configuration, and consists of the same oſseous vertebræ: it also has the soft solid parts, such as the *medulla longa*, which traverses each vertebra, and perforates the smallest: it has nerves, muscles, veins, arteries, a heart, a numerous aſsemblage of glands containing that acrid milky fluid which exudes through the skin when the newt is irritated. Both the fore and hind legs have nearly as many soft solid parts, and hard solid parts or bones, as those of quadrupeds, and almost as we have ourselves. Finally, a rudely circular bone surrounds and terminates the mandibles of our amphibia, from which a little regular forest of the sharpest teeth projects. Who could have supposed that this quadruped had the property of reproducing such an aſsemblage of parts so different among themselves? But it is most undoubted: for, besides being the first discoverer myself, I have witneſsed it repeatedly. Losing the whole four limbs at a blow is nothing to a newt, because it can reproduce them all, and reproduce them perfectly. I have taken the trouble of numbering the bones in these limbs, and found them to be ninety-nine: and ninety-nine have existed in the four reproduced limbs when all were amputated from the trunk. Nay, let the four legs be completely cut off, and the whole tail, as also the two mandibles; the newt, in addition to reproducing the limbs, will at the same time repair the jaws and the tail. This fact, which has so much the appearance of a paradox, and at first sight seems more fabulous than the famous Lernean Hydra, I have repeatedly seen and shown to many friends, to the great amazement of them all. The water-newt is so much more the object of admiration, since it never defrauds the eager experimentalist of its multiplied reproductions, which is otherwise with snails, as some of them will not reproduce.

Behold the evident existence of reproduction, beginning with the polypus, proceeding to various worms, then to snails, and lastly, to water-newts! that is, advancing from the most simple animals to others leſs simple, and from these to some whose organic structure is more complicated; and there is no eſsential difference produced by the more simple or more complex organization.

These facts also prove, that the tenderneſs or delicacy of fibre is by no means a condition neceſsary for animal reproduction. How great is the difference between the body of a polypus and the tail or limbs of a water newt? But do not both reproduce in the same manner? How many small animals are there, as delicate as the polypus, even much more so, and as completely aquatic, which, instead of reproducing when cut asunder, inevitably perish? as I have ascertained by numerous experiments.

However it is proper to remark, that of the animals adapted by nature for reproduction, those provided with the more tender fibre have a singular prerogative over the rest. In the first place, the defective limbs begin sooner to be repaired. A polypus, divided into many pieces, in a few hours begins to multiply into so many other polypi; an earth or water-worm requires a few days; a snail or newt, on the contrary, requires several weeks, before beginning to reproduce. Secondly, reproduction is much sooner complete in the former. Only a few days are neceſsary for a polypus; worms require whole weeks; the snail must have several months for repairing its head; and a year is not sufficient for the new limbs of a newt to grow as large as the old. Thirdly, the same animal, so long as young, and the fibre consequently more tender and pliant, will reproduce the lost parts quicker. This I have seen in newts, and also in snails, which will repair the severed head in six weeks, and much sooner, if young. Finally, reproduction is more tardy, as the natural softneſs of the animal decreases. We have a striking instance of this in frogs. If, while still tadpoles, but the limbs beginning to appear, their limbs should be amputated, by my own observations it is certain that they will be most completely repaired. But the same will not succeed when the tadpole has aſsumed the figure of a frog: then it is never or almost never, that the trunk puts forth a new limb. Whence arises so great a difference in the same limbs of this amphibious animal? Shall we say, that this virtue, this reproductive power, which the animal enjoyed while a tadpole, has been lost by it becoming a frog? as if, by the metamorphosis, it ceased to be the same animal, which is but an unphilosophical sentiment. I find it more consistent with truth, to suppose the reproductive power continues in the frog; it is enabled to operate in the tadpole, by means of the great tenderneſs of fibre, but its action is afterwards prevented from the succeeding induration. Let us endeavour to elucidate this a little. The frog, while a tadpole, never leaves the water; and it would perish on attempting to do so. Only from time to time does it dart from the bottom to the surface, and, for a moment, puts up its mouth, to expel the air from its lungs, and inspire what is fresh. The trunks of the amputated limbs then remain in a state of the greatest softneſs, being always immersed in water, and bathed by it in every point. The minute limb, yet a germ, will be able to perforate the trunk, if this expreſsion may be used, to come out and freely expand. But the same thing will not happen, when the frog has attained its full and permanent size. Then, as it generally remains out of the water, or retreats thither only when menaced by danger, the trunk will be subject to the influence of the air: thus it will cicatrise; and the contraction, occasioned by the cicatrice, will prevent the reproducing germ from breaking through and expanding. The mutilations of snails, hitherto mentioned, were for the most part performed when spring was somewhat advanced; because I had observed, that no leſs that 61° of heat was neceſsary to obtain reproduction, which we generally have not in Lombardy before that time; and if they are then decapitated, it is certain that the snails, at least many of them, will repair the head. But what will ensue, if decollation is towards the middle of September, or when the requisite heat does not continue with us more than a month, on account of the supervening autumnal rains? I have instituted many experiments for elucidating this curious inquiry, and obtained the following results; if the mutilated snails were exposed to the heat of a stove, equal or surpaſsing the neceſsary degree, I was sure of repropuction before the end of winter. If kept in a situation where, for some days, they might be exposed to the cold of freezing, the greater part perished. When the cold was leſs, they retained the power of reproduction, which re-appeared in spring; and the head and horns, having begun to grow at the commencement of winter, attained their full size in the subsequent spring. If decollated in the beginning of winter, and care taken that they did not perish with cold, though without being kept in a stove, no reproductive principle appeared on the plane of the trunk; but it became evident in May, and advanced to perfection during the summer months.

The same mode of regeneration practised by nature in the reproductions of snails she also practises in those of newts, of earth-worms, and water-worms; with one variation, however, that these animals reproduce, though slowly, at the temperate degree, which arises either from the great softneſs of their fibre, or from something peculiar in their nature.

When engaged with the reproductions of earth-worms, it struck me to try whether the reproductive power was exhausted by the first reproduction, and I found that it was not. Thus to the second reproduction succeeded a third; and this being taken away, there came a fourth, then a fifth, and so on. If a portion of such succeſsive reproductions were cut off, the second reproduction entered the first, and the third the second, &c. Thus I came to have a scale of reproductions united to the old trunk, always younger, smaller, and the colour gradually lighter.

These regenerations of reproductions equally succeeded in the tail of tadpoles, and, what is more surprising, in that of newts, and likewise in their limbs, though the parts of these two members are so different from each other. Therefore, if the four limbs and tail of a newt, already reproduced, are amputated, other four limbs and a tail will regenerate a second time; and this experiment may be considerably protracted. Indeed, with young water-newts, where the reproductions were prompt, I obtained six succeſsive reproductions of the limbs and six reproductions of the tail during the months June, July, and August. In one of these animals, I counted six hundred and eighty-seven bones reproduced.

In consequence of these reproductions in earth-worms, tadpoles, and newts, I thought of trying whether they would succeed in snails; and, for that purpose, mutilated several, some of the horns, and others of different portions of the head, or the whole; and I cut off whatever parts were renewed, exactly where they joined the old trunk. The second reproduction did not fail to take place and succeed in the same manner as the first; and this also happened with a third reproduction; but the death of the snails prevented me from extending these curious experiments further.

Another suggestion occurred, besides this inquiry; which was to investigate whether the reproductive powers could at last be exhausted, or whether they would always succeed, so long as the animal lived. And the experiment might have been begun on newts in preference, selecting the youngest, because this amphibious animal is easier mutilated than snails, more tenacious of life, and reproduces more readily; but I had not leisure for such experiments, which, if undertaken by any expert naturalist, will undoubtedly tend to utility, and may form a new chapter in physiology.

In the whole course of this Eſsay, I have delivered the results of my experiments only, and always ſuppreſsed the details. Had I related theſe, it would have been a volume, not an Eſsay; but I was deſirous of instructing the reader, without fatiguing him by long circumſtantial narratives. I always hope to have obtained ſufficient credit with the public to merit belief. It gives me pleaſure to obſerve, that almoſt the whole of theſe reſults are confirmed by diſtinguiſhed naturaliſts, as will appear in a ſecond memoir on the reproductions of ſnails, where an abſtract ſhall be given of the writings in my favour, and, at the ſame time, one of all thoſe that attempt to controvert them. The confirmers, as far as I know, are Meſsrs. Turgot, Lavoiſier, Tenon, Heriſsant, Bonnet, Senebier, Schæffer, Roos, Muller, Scarella, Troilo, beſides three other Italians, celebrated profeſsors of anatomy, who, having recently repeated my experiments, and found them true, have been ſo obliging as to communicate their memoirs. The controverters are Meſsrs Murray, Wartel, Cotte, Bomare, Adanſon, Schroeter, Argenville, Preſciani. In my ſecond treatiſe, I ſhall likewiſe examine the value of the impugnations with philoſophic impartiality, and ſhall not fail to give the merit of the impugnators its full weight. I am very far from supposing that my discovery will form an epoch in natural philosophy; it will rather form an epoch in the history of the human mind, to see how an experiment, so certain, so easy as that is, of obtaining the reproduction of the head of the snail, has deceived such a number of philosophers,—and, what is more astonishing, in an age which seems to be that of observation and experiment, if, on the other hand, it was not remarkable that experiments are made by every one. But the proper method of experiment has always been, and will always be, confined to very few.

ESSAY XXX.

On the Culture of Beans.

It is difficult to cultivate rich moist soils to full advantage, without the aſsistance of this plant, which has two qualities of singular importance; first, that of extracting very little from the fertility of the land; and second, preparing better, perhaps, for wheat, than any other crop.

It is uncommon to give more than one earth for beans, and generally improper, for they love a whole firm furrow, and never thrive better than on a layer.

In Kent, they find that no plant pays better for dung, but it is uncommon in Suffolk to afford them any; yet dunging fallows for wheat is found in all parts of the county, and is a most barbarous practice. Where this husbandry is pursued, there could be no improvement more obvious than giving the dung to beans, and then taking the wheat.

Beans have been dibbled a row on every flag; by others, on every other flag. I have found it more advantageous to plant in clusters four or five beans in every hole, and eight or nine inches from hole to hole, which admits much better hoeing than when more thickly set. Dibbling is the best and most effective method of cultivating beans.

The time of sowing is guided by the season: as soon as the land is dry enough in the spring to work well, is the right time; and February, in that case, a proper time; but they do well all through March.

In Kent, both horse and hand-hoes are for ever at work, and the crops are kept in a degree of garden cleanneſs.

The Kentish method of shimming the stubbles of beans, cannot be too much recommended: whatever may have been the hoeing, there will remain some weeds; these ought not to be ploughed in, but cut shallow on the surface, harrowed out, and burnt, or removed to the compost dunghill. By repeating this operation to absolute cleanneſs, the land is left in garden order for wheat.

ESSAY XXXI.

On Farm Horses.

On the economy of the stable depends, in no small degree, the profit or loſs of the husbandman; since, if the working cattle are disproportioned either in number or size to the exigencies of the farm, or if properly adapted in these particulars, should turn out unhealthy, either from natural causes or an undue attention in the persons to whom the management of them is entrusted: or if they are over-worked, or on the contrary not kept with a sufficient degree of strictneſs to their labour; if they are pampered too high, or have not a due allowance of food: in either of these cases the owner will find an evident diminution in his profits; and, if not timely redreſsed, a want of attention to these minutiæ, as they may at first sight appear, will increase by slow progreſsions, till the evil may at length terminate in the ruin of those people who have been remiſs in this part of their busineſs.

The number, as well as size of the working horses, must depend on the situation, extent, and nature of the farm; since one team on a gravel, sand, or other light soil, will cultivate a larger proportion of ground in a given time, than two on a clay, where the native adhesion of the soil enhances the difficulty of the several operations of the field, and where the deep and miry roads render a larger strength of cattle abundantly neceſsary. Again, the farmer whose fields are hilly and uneven, will be under the neceſsity of supplying himself with more able horses to answer this superior strength of tillage, than another whose lot has thrown him on a level situation. Such people also who have a large proportion of wood land, or who from any other cause are obliged frequently to perform long journeys, demand an abler team than he, whose chief employment is the tillage of his ground, and is therefore rarely under the neceſsity of travelling on the road, except in the neceſsary conveyance of his grain to market, the proximity or distance whereof is an object of no mean import to the farmer; since, if his situation be in the vicinity of a market-town, more corn may be delivered in one day, than in two or three where the barns lie at the distance of eight or ten miles, or perhaps farther, as is the case with many farms; and if the various items saved by this contingency were to be added together at the year's end, they would, I am persuaded, form a much larger sum than is generally imagined.

The proportion of meadow or feeding land to the arable is likewise to be considered in regulating the number of working cattle on the farm, since when there is a due allowance of the former, there will be leſs employment for the horses; and consequently on these farms, where there is an equal division of arable and green land, one team will be amply sufficient, where there would otherwise have been a neceſsity to employ two or three.

The sex of the labouring cattle will likewise be determined by the nature of the farm, as it may be more convenient to employ geldings if there is a want of pasture, whilst a due portion of green land may encourage the farmer to drive chiefly mares, by which means he will have the advantage of breeding colts, and thereby of furnishing himself with a constant succeſsion of young cattle at a trifling expense; and this is so material a consideration, that it ought never to be neglected where there is an opportunity of reducing it to practice; since, when a person is obliged to supply the deficiency of his team, whenever age or accident render it neceſsary for him to recruit his stock, by having recourse to the dealer, it forms a continual drain from his pocket, and lays him under the neceſsity of expending a considerable sum in the purchase of working cattle, which, when he has the advantage of breeding them on his own pastures, might be reserved towards the purpose of buying other stock, and his team would in all probability be more completely furnished from his own breed, than by any which he could purchase from the horse-dealer, with whom he runs great hazard. Other advantages likewise attend the husbandman who is fortunate enough to poſseſs a quantity of pasture land in due proportion to the arable; I mean advantages pertinent to the subject in hand, for as to the general superiority of farms of this description over mere arable tenures, it is so manifest, as to occur in a thousand instances; but in this particular one of the management of the teams, I would mention the being able to turn out a sick or lame horse, and thus in many cases expediting a cure in a much more effectual manner, and at far leſs expense than if recourse were had to the farrier. Besides, where mares are kept in preference to geldings, a disorder which would totally disqualify the latter for busineſs, will render the former by no means leſs proper for breeding, and thus she may still continue useful in this particular, whilst her offspring supply her place in the harneſs.

In those countries where the ploughed land is stiff and perfectly free from stones, and where the pasture is of the richest kind, the use of horses is in a great measure supplied by oxen, which being turned out of the team into the feeding pasture, bring a double profit to the owner. The expense of maintaining these creatures in good working order, bears no proportion to the consumption in hay and corn required for the horses, besides the very material saving in the article of shoes, wherein a horse-team considerably enhances the blacksmith's bill. These advantages speak greatly in favour of an ox team, where the situation will admit of the practice; but where the land is stoney and uneven, and the roads hard and rugged, and where the farmer is not poſseſsed of a sufficient quantity of good fertile meadow land to admit of the beast being fattened on the pastures, when he has been worked a sufficient time: when either of these circumstances are wanting, it is certainly the most judicious method to employ a horse-team; for the ox, at best a slow mover, would make but very indifferent way on ground that is hard and stoney, as in that case he must neceſsarily be shoed, and this is a task of no small difficulty, these animals being endued with far leſs docility than the horse, and are generally cast whenever this operation is performed. Besides, where the farmer has no convenience of fattening the oxen when past their labour, he must often sell them at a disadvantage to the feeding grazier, so that on these considerations the horse is by far the most useful beast; but in deep miry countries, as I observed before, the ox may be employed to great advantage.

The horse is subject to a greater variety of disorders than any other of the animal race, and these are often aggravated by ill management; nay, I believe I might add, that more distempers are brought on by a neglect or improper regard to the creature, than what proceed from natural causes.

As the complaints incident to this animal are more numerous, so is he more susceptible of injury from the different viciſsitudes of heat and cold, than any other creature. The ox, when he has finished his stated task for the day, is turned abroad to feed, without any other care from the hind; whilst the horse is taken into the stable at the close of his labour, and diligently attended during the remainder of the day, and at night left to repose on a dry and well-shaken bed. The horse meets with an early attention in the morning, and is alternately fed and curried before he goes forth to work, in order to enable him the better to withstand the fatigues and labour of the ensuing day; the ox, on the contrary, fearleſs of the summer's sun and winter's blasts, is taken out of the field, and with very little ceremony harneſsed for his work.

Such being the care required in the management of a working-team, how neceſsary to the farmer's interest is it, to be provided with a set of domestics sober, honest, and diligent, who by obliging their horses to do a good day's work at whatever busineſs they may be employed, and by a frugal, yet neceſsary allowance of meat in the stable, and by a proper attention to the dreſsing and well ordering of their cattle, will take care that their master's interest be promoted, and his welfare consulted in every particular. But however ardently the poſseſsion of servants with qualities like these is to be wished for, I believe there are few that have kept dependants of any kind who can boast of having often met with those which have turned out perfectly to their wishes; perhaps if we were to extend our inquiries in this particular from the prince on the throne to the villager, whose only attendant is a dirty girl; I say if we could search into the characters of these various degrees of servitors, we should find that all of them in their several stations, so far from studying the interest and profit of their master, directed their views towards enriching their own coffers, at the expense of their employer; and whilst the courtier has his parasites and dependents to share with him in the plunder of his Sovereign, the solitary domestic of the villager abovementioned finds some char-woman or itinerant ballad-singer, to receive the scraps of the pantry and the refuse of the kitchen.

In this progreſsive scale, there are none who study more arts of deception, and perhaps there are few of the several ranks and denominations of servants, from the palace to the cottage, who have fairer opportunities of exercising their dexterity in this way, than those employed by the husbandman. Being brought up from their infancy in the lowest habitudes of trick and knavery, and observing in their parents, and in every one of their own order, a kind of emulation at excelling in every mean art and chicanery, and consoling themselves with the satisfaction, that so long as they keep within the letter of the law, and are free from capital offences, they may with impunity continue in the practice of this lower rank of vices, it is matter of little surprise that they should imbibe their parent's notions: and thus the ploughboy is no sooner admitted into the stable, than he is initiated into the vices of that seminary, and shows himself an apt and ready scholar by pilfering his master's corn, which as it is given to his master's cattle, the waggoner (his worthy tutor) persuades him is a matter of trifling concern, and by no means a breach of the seventh commandment; till, by a frequent repetition of this crime, and from the force of example in his fellow-servants, he is led on to the commiſsion of other acts, where this kind of casuistry does not so properly come in aid of his wounded conscience.

Since these arts too frequently are practised in a farmer's stable, how careful ought he to be that his working cattle do not suffer either from the neglect of the ploughman, or from his over-solicitude to be poſseſsed of a fat and sleek-looking team. Such horses may indeed attract the eyes of a gaping crowd at a country market, but will never answer the purpose of the farmer in getting through their daily labour with a moderate proportion of meat; and a due attention to these particulars would, I am persuaded, be the means of preventing many of the disorders to which this useful species of animals is naturally subject.

Few of the people whom I have now described, namely those who break the bonds of every social tie to feed and pamper their favourite animals, will use the horses with cruelty, or neglect the management of them in the stable; but there are others of a different cast, who being by nature indolent, and of a morose and evil disposition, proceed to their work with disgust, and spend those hours which should be appropriated to a neceſsary attendance on the horses at the alehouse or the forge, or in short at any other place but where they are wanted. These often degenerate into the contrary extreme, and not only waste their master's property by neglecting his interest, but, careleſs of the welfare of the horses with which they are entrusted, incapacitate them for buſineſs by their ill-usage and want of attention.

The poſseſsion of a fat team is likewise not unfrequently the master's pride; and when this happens to be the case, one can hardly blame the servant in any deception he may use to promote a sleek and comely appearance in his cattle, since by these arts he is likely to purchase his master's favour; and where a farmer is thus attached to the silly emulation of excelling his neighbours in this particular of a fat team, the allowance of corn it may be presumed is very ample, and the labour required from the horses by no means fatiguing.

The management of the plough-team varies eſsentially in different countries, and even in different parts of the same county; whether we consider the labour to be performed as a day's work by the same number of cattle, the quality and quantity of their food, or the stated hours for baiting and attendance. In the eastern part of Kent, the waggoner or head ploughman pays an early regard to his horses, and baits them continually with chaff and corn from the time of his rising at four o'clock, till six or seven, when the day's work commences; and in the afternoon, whilst the mate is baiting, the waggoner employs himself by cutting cavin into chaff, or where this is not in sufficient plenty, hay and straw mixed, and sometimes oats in the sheaf. At eight in the evening he goes to bed, and leaves the attendance on the team to his mate, who sits with them till ten, so that the horses are left but a few hours to themselves; and this diligent attendance is unavoidably neceſsary, since in this country the horses are not permitted to have any rack-meat, but have generally a full allowance of corn; whereas on the other side of the county, the stable door is rarely opened of a morning before five or six o'clock in the winter, and by nine in the evening the horses are racked up and left to their repose; and as by this method of giving the horses rack-meat, the leſs chaff is required, so there is generally a sufficient quantity of this produced by the thresher; if not, the labour of cutting does not often fall to the share of the ploughman, but is paid for by the farm[illegible] person who is expert at this busineſs.

In support of the former practice may be urged the reserve of a considerable quantity of fodder, which when given to the horses without limitation, forms a large item in the rural acounts at the end of the year, especially when the situation is within a small distance of London, or any place of considerable note where hay usually fetches a large price; to which may be added the advantage which the horses reap from the constant attendance that must neceſsarily be paid to them when baited in the manner before described, whereby the servants are kept continually in their work, and prevented from loitering away the afternoons at the ale-house or the smith's shop, as is too frequently the case with those who have more leisure on their hands; a great expense is likewise saved, which must otherwise be paid for cutting chaff. On the other hand, the farmer who prefers the more general custom of allowing rack-meat to his horses, may enumerate the following advantages accruing from this method: First, the weekly allowance of corn may be more sparing, where the horses have constantly some kind of rack-meat to resort to, than when their whole dependence rests on the manger; nor is it neceſsary that such rack-meat be wholly confined to hay, but may consist partly of pea or bean-straw, at those times when the labour of the horses is light; and in seed-time, or whenever the team is tasked with heavy work, though sainfoine, clover, &c. may be allowed them of a night, yet this need not be given to an un-limited degree, which indeed would quickly end in the consumption of a large stack, but be truſsed out in such proportion as the master may judge expedient, obliging the servants to tend the horses with chaff in the afternoon. Under these restrictions, the consumption of fodder may, perhaps, not exceed in value the sheaf corn allowed to the teams in East Kent. A second consideration in favour of this practice, is in having the ploughman at leisure in the afternoon to employ about occasional jobs, whilst in East Kent these domestics have a just excuse for refusing to lend a helping hand towards expediting any other work than what appertains solely to the management of their horses: and this advantage of having the servants at liberty to employ in the afternoon is of no inconsiderable moment, since by their efforts many jobs may be accomplished, which would otherwise have demanded the aid of a labourer, the expenses of whose hire in the course of a winter will swell up to a large amount; not but there are many farmers who never employ their servants in an afternoon to any other work than what the care of the horses affords them; and this relaxation on the part of the master, has given so great encouragement to the servants in their obstinacy, as to furnish a pretext for disobeying every order but what respects the horses or the work to be done by them; a disposition which there seems no other means of correcting, but through the medium of that neceſsary officer of justice, a civil magistrate, who never fails on application, to back the master's intreaties with a threat of Bridewell, in case of the servant's obstinacy and refusal, a measure which generally secures their compliance.

To the two considerations last mentioned may be subjoined a third, which in the end may turn out of more consequence than either of the former, and that is the opportunity enjoyed by the farmer who gives his horses rack-meat, of seeing the stable door locked up at night and opened again in the morning; and this cannot be so conveniently done where the ploughman is to sit up late and to rise the next morning at three or four o'clock, and thus an object of the most serious consideration is left to the care of fellows, who are rarely deserving of any trust; namely, the danger from fire, whereby the negligence of the servant may involve a family in total ruin, not to mention the great waste of candles in the many dark hours wherein the ploughman is neceſsarily engaged with his horses.

Such are the different modes of conducting the economy of a farmer's stable throughout the winter months; where, without the most vigilant caution on the part of the master, such waste will be committed, as to render fruitleſs and abortive his most laborious exertions in the field.

Whichever of these methods shall be preferred, it is obvious that the maintenance of the horses in a condition to go through their winter's labour will be attended with no trifling expense; and therefore it should seem a matter of prudence to be furnished with green meat early in the spring, that the teams being turned into the field, or having a sufficient quantity of graſs mown for them, the expense of corn may in a great measure be saved: for so highly nutritious are the juices of green food of every kind, and so agreeable is this provender to the taste of these animals, they will go through more severe labour, carry a smoother coat, and thrive abundantly faster on this meat alone, than with a full allowance of hay and corn; so that there are many farmers who never give their horses corn during the summer months, whilst others take off half their winter's allowance. This is a great saving, besides the advantage of employing the ploughmen in the latter part of the day at various kinds of busineſs, which as the spring advances, become neceſsary to be expedited.

The most general food for working-horses in the first part of the summer, when not turned to graſs, is that arising from the tare. This succulent herbage is raised from the small seed called winter tare, which ought to be sown with all convenient despatch after harvest, on a piece of ground in good condition, and at no great distance from the yard: much depends on the nature of the soil and the state of the weather during the winter and spring months, as to the season when these pulse will produce a crop fit for the scythe; but if the weather has not been very unkindly, they may be expected to turn out a tolerable good swarth at the beginning of old May, and when this first provision shall be expended, the clover and spring tares will come in, so as to afford the horses a constant succeſsion of green meat during the summer. And this method of feeding them with green meat in the stable or in the yard, (for there are many people who contend in behalf of the superior advantage in point of health, when the horses are turned into the yard of a night, and there fed from the crib, over the mode of keeping them continually in the stable,) the practice, I say, of confining them to their meat, is far preferable to that of turning the horses into a meadow when their day's work is finished, and this on many accounts: First, by having their meat cut for them, they avoid the continual plague of those tormenting insects, flies, which are a perpetual ſource of complaint to cattle of every kind when feeding abroad in the summer months. Secondly, by thus feeding and reposing themselves at home, the mischief likely to accrue from the horses breaking out of their pastures is obviated: whereas when they are turned into the uplands, although the graſs be never so good, the gates well secured, and the fences strong; yet so tempting is the verdure of every field at this season of the year, and the horse an animal so prone to ramble, that the danger of their quitting the pasture allotted them during the night is very great; and in such case a team of horses may create more mischief in six hours, than 20l. or perhaps 50l. will repay, besides the plague of seeking them in the morning, the greatest part of which may haply be consumed in a fruitleſs inquiry, and half the day be gone past ere the teams are harneſsed for their work. Thirdly, the waste which is made either in a piece of graſs or clover where the horses are suffered to ramble over the whole close *ad libitum*; it being a clear case, that the produce of one acre of green meat given in the rack will maintain the same number of horses much longer, than three acres would have done if they had been suffered to go over the field at their pleasure. Add to these another consideration, which to a farmer is a matter of the utmost importance; and this is, the waste of the dung and urine; since it is universally allowed, that the soil of the horse dropped casually in various parts of the field is of little or no use, the virtues of it being exhausted by the heat of the sun, and the surface of the ground prevented by this covering from putting forth a fresh shoot of graſs, whereas when the team is fed with green meat in the stable, with a plentiful allowance of litter, the dunghill will be considerably raised during the summer; for this food being very succulent, acts with the animal as a powerful diuretic, by which means the straw is quickly converted into manure, and becomes a valuable addition to the repository of a farm-yard. I know but of one argument which the advocates for grazing their horses abroad can bring in favour of this practice; namely, the keeping the animals in health by action, to which they are naturally inclined, and thus preventing the accidents of swelled heels, &c. But this advantage is by no means precluded, when the mode of feeding the team with green meat in cribs is pursued, as hath been touched upon before; and here they may have the free enjoyment of their limbs, without any of those hazards so likely to ensue from their feeding abroad; though when a horse is kept with proper strictneſs to his work, I believe there will be little danger of his becoming greasy by standing in the stable at night, except in some particular constitutions.

Though tares are a very wholesome diet in the first part of the summer, they should be cautiously given, or rather wholly discontinued as the summer advances, and they are become rotten on the ground. At this time I am convinced they are a food highly improper for the horses, and when given in that state frequently turn out very prejudicial to their health; for this vegetable, from its extreme succulency, contributes to fill their bodies with ill humours, from whence originate disorders of various kinds, such as yellows, staggers, farcy, and other fatal or incurable maladies. On this subject I can speak with the greater confidence, as the major part of my own team fell a sacrifice to this imprudent conduct in the year 1773. In this summer several of my working-horses were carried off by the staggers, occasioned, as I am well persuaded, by their feeding in the month of June on summer tares, which were remarkably groſs, and by being lodged, had become rotten on the ground. To avoid this pernicious consequence, it seems the best method to discontinue the use of tares as soon as the clovers become fit for the scythe, and where there remains no other alternative, rather to turn the team abroad, than to endanger their healths by suffering them to feed on such foul and unwholesome diet.

But to guard effectually against every obstacle, the most prudent way is to raise a field of lucerne in the vicinity of the yard, which will afford a plentiful supply of wholesome and nutritious aliment till the time approaches for taking the horses up to dry meat. The first cutting of this excellent vegetable, if properly managed, may commence a fortnight or three weeks before the tares will be ready for the scythe, and the mowing may be continued throughout the summer without any danger to the cattle, and to the infinite emolument of the farmer, who will thus poſseſs an opportunity of furnishing his horses with a wholesome food, and that in great abundance, and at a trifling expense, till the return of winter renders it neceſsary to discontinue the green meat, and the tares and clovers may be reserved for the other various purposes to which they are capable of being applied.

It is a very salutary practice to bleed the team previous to turning the horses to graſs in the spring, and to repeat it when they are taken up to dry meat at the autumn, though there are many people who object to these periodical evacuations, alleging that the constitution of the animal is rather injured than otherwise by this habit. But when it is recollected, that the horse is subject to a greater variety of disorders than any other quadruped, and from his constant labour is particularly liable to have his blood and juices contaminated, it must be evident that this disposition is likely to be increased by a change of diet, particularly on a sudden transition from dry fodder to green meat, where from the superabundant succulency of the food, the humours, which at this season of the year are in continual flux and agitation, will be accelerated to that degree, as to bring on disorders which may terminate in the death of the creature, and which might not in all probability have taken place, if a copious discharge of blood had been promoted some few days before the winter provender had been discontinued; nor is the autumnal bleeding leſs neceſsary to carry off any foul humours which the succulency of the graſs may have occasioned, and to preserve the health of the team during the winter; and if to this bleeding a dose or two of physic were to be added, it would be a still further means of insuring the health of the horses, and rendering the farrier's attendance unneceſsary.

The proper time for taking the horses from graſs is about Michaelmas; for though we have often warm sunny weather till the latter end of October, yet the graſs by that time will have lost much of its sweetneſs, and become leſs nutritious.

One acre of whole ground is accounted a good day's work for a plough and four horses, if the soil is of a middling texture; but in stirring fallows, when the days are long, and the land pulverized by the former tillage, on very light soils, an acre and a half may, with great facility, be ploughed in a day by a four horse team.

On stiff lands it will be neceſsary to unite an additional pair of horses to the team, and this renders the expense in tillage on these grounds much more considerable than on the lighter soils; but this increase of charge will be amply compensated by the future crop, which never fails to be more abundant and productive than what is raised on the thin grounds.

The term for the mares going with foal is eleven months, with the addition of a day to every year of the animal's age. The mare which is intended to supply the team with draught colts, should be large-limbed, closejointed, short-necked, wide-chested, home-ribbed, with a capacious body; her eyes should be clear, full, and pellucid, and her nostrils large and open; in disposition she ought to be gentle and tractable, of a constitution healthy and vigorous, free from any blemishes either hereditary or acquired. The horse should be bold and spirited, well made, and of a kindly disposition; his constitution should be strong, his temper good, and in short, neither in mind or body, ought he to be contaminated with vices or disease of any kind, since on the good qualities and strength of constitution in the sire and the dam, depends in a great measure the future welfare of the colt. The proper time for putting the mare to horse is in the months of May or June, according to the fertility of the soil, always observing that an early colt is to be preferred to one which falls later in the season.

During the time of gestation, the mare may work in the team as usual, till within a fortnight of the time when she is expected to foal; but it is neceſsary that her labour, as she advances in her pregnancy, should be gradually slackened, lest any hurt should accrue to the foal or the dam by hard exertions in the harneſs, which might probably occasion the mare to slink her foal, or perhaps might be productive of still more dangerous consequences. The mare, within ten days or a fortnight of the time when she is expected to foal, should be turned into an orchard or other warm inclosure, where she may rest secure from the interruption of other horses, and be free from any annoyances likely to occasion disturbance to her at this time, and after foaling should be allowed to run with her colt in the same pasture for a month or longer, if not particularly required in the team. The field set apart for the dam and colt should be free from declivities or precipices of any kind, and the graſs should be of a length to afford a good bite, and to furnish sufficient nourishment to the mare for a copious supply of milk.

During the time that the colt runs with the dam, it ought never to be allowed to suck whilst the mare is warm from the consequence of her labour, as the milk at that time would be highly prejudicial to the young creature.

The proper time for removing the colt from the dam is about Michaelmas; and at this time care should be taken to keep the mare and foal from the hearing of each other, that neither the mare may bewail the loſs of her colt, nor the latter fret and pine after its mother. The best method will be to confine the foal in a small stable by himself, which should be furnished with a rack and manger, where he may be fed with well-shaken hay and clean-sifted oats, bruised a little in a mill. With this management he will quickly forget his dam, and become gentle and familiarized to his keeper, and in fair weather may be suffered to exercise himself in a pasture adjoining to the stable, but this should be only for a little while in the middle part of a sunny day, the tenderneſs of the young animal rendering it neceſsary that he should be kept under cover during the winter.

Having been thus properly managed in the first winter, he will by the following spring have made rapid advances in growth, and as the warm weather comes on may be suffered to range throughout the day in his pasture, and at night be lodged in the stable, and when on the approach of summer it will be no longer neceſsary to bring him into the house, he may continue in the pasture as well during the night season as in the day.

The proper age for gelding the colts is at ten days or a fortnight old, or as soon as the stones are come down, and the most proper season is the months of April or May, and if not done at that time it ought to be deferred till the end of September. Although it be safest to cut the foal at the age above-mentioned, yet the operation may be performed without hazard at two years old.

The like care in respect to housing the colt is required in the second winter, as was directed in the first, only that now he may be led by the halter to the pond, be frequently curried, and accustomed to such other acts of familiarity which have a tendency towards rendering him tractable and obedient, so that at the return of summer his harneſs may be put on, and he may be employed in some kind of gentle draught work in company with other horses; but this exercise should at first be very light and easy, and not protracted too long, so that the young horse may seem rather pleased than disgusted with his new employment. He should often go short journies in the team upon the road, that his sight may be early inured to different objects, which will dispose him to be more tractable and leſs addicted to fear than he would have been if this precaution were neglected. By this management, and by alternate easy days work at plough and in the waggon, the young horse at the end of the summer will become able to perform nearly an equal share of labour with the rest of the team, and having been fed and managed in the like manner with the other horses, may, at the approach of winter, be taken into the stable with them.

The docking of colts may be performed when they are a twelvemonth old, either in the spring or autumn, but it ought never to be done in the summer months.

Those people who have great store of waste pasture, such as heaths, moors, &c. poſseſs the fairest opportunity of breeding colts, which are here reared at a trifling expense, and having plenty of room to sport and range at pleasure, with good and wholesome water, do grow out to their full size, and become more serviceable for the team than those which, from a more confined situation, have not enjoyed these advantages.

ESSAY XXXII.

On Rye.

This grain bears, of all others, the nearest affinity to wheat, as well in the formation of the seed, as in the manner of its growth, and the purpose to which it is in some countries appropriated. But though in many foreign countries, and in Scotland, and some of the northern provinces of this kingdom, rye-bread constitutes a considerable portion of food among the lower ranks of people; it is by no means so nourishing as bread made from wheaten flour, and to those who are unaccustomed to it would prove both unpalatable and unwholesome, being of a very opening quality, and has been often productive of violent diarrhœas and other complaints in the bowels.

The chief purposes to which rye is applied in the southern parts of the kingdom, are either to feed off the green blade with sheep, or if reserved for a crop, to sell to the tanners, who make use of this grain in the way of their trade. Rye straw is used by the collar-makers, and fetches a price superior to any other.

The time for sowing rye, with a view of depasturing the field with sheep, is from the latter end of August till the end of September, according as the harvest is more or leſs forward. This grain, when intended for the purposes above mentioned, is usually sown at one ploughing of a wheat gratten or other stubble, where the field is to come in course for a turnip-fallow the next year.

The quantity to be sown on an acre is two bushels and a half, if intended to remain for a crop, but when this grain is sown for sheep feed, it is proper to allow three bushels to the acre; as where the blade forms the primary object, a much larger proportion of seed is requisite, than when the crop is meant to remain for harvesting.

As this grain comes into spindle a month earlier than wheat, it is neceſsary in the feeding of it to attend to that circumstance, otherwise the chief end of sowing it will be defeated; for unleſs the sheep are turned on the rye before the ear is formed in the hose, that is to say, before the expiration of the month of April, the blade will have become hard and sticky, and the succeſsion of pasture, after the first growth has been taken off, will be very trifling. In mild winters the stock may be turned on the rye field in February, and the buſineſs may be continued at proper intervals till the middle of April, after which time it will fail to yield any farther use as a pasture. In a backward spring, and after a severe winter, it will be somewhat later ere the rye will be advanced to a proper growth for feeding, as it is much better to wait till the pasture becomes prolific, than to turn the cattle on the field too early, observing that this be done before the spindle be formed.

Farmers who maintain large flocks of ewes and lambs, do generally cultivate a few acres of this grain, as being a food which, above most others, causes the milk to flow in large abundance, and that at a time when there is a great scarcity of succulent herbage: for the turnips not having begun to shoot, and the roots becoming hard and sticky, afford but little milk for the ewes, and are a very sorry provision for the lambs. Whereas, by shifting the couples into the rye towards the middle or latter end of February, or (if the spring be backward) in the following month, and keeping them to that food about a fortnight, the turnips will then have begun to send forth abundance of sprouts; and by this management a greater supply of food will be procured, and that of a much more nutritious kind, than could poſsibly have been attained but by the help of the rye field: besides, this removal to a different species of food will be a variety, which is a matter of some consequence, since it is wholly impracticable to make fat lambs but by frequently shifting them from one pasture to another.

In feeding rye it is neceſsary to part the field with hurdles, allotting to the stock a quantity of ground equivalent to the number of sheep, by which management one part of the field will be freshening, whilst the other is feeding off.

As the rye ground is to come in course the next year for turnips, it seems of some consequence, where manure can be procured in sufficient plenty, to lay a slight covering of yard-dung on the wheat gratten previous to breaking it up, which will cause the rye to grow away with greater celerity, will enable it to produce a more liberal supply of food for the sheep in the spring, and be a wonderful help in lengthening out the turnip crop.

In April, when the rye has been fed down a third time, it will be proper to plough the ground, in order that it may be got in readineſs to sow with turnips at Midsummer: but it is to be remembered, that if an opportunity had not offered of carrying the dung on in the autumn, it will be highly neceſsary to give the field a dreſsing of some kind previous to the turnip season, as the growth of the rye cannot but have exhausted the land much more than it will have been improved by the dung and urine of the sheep.

Notwithstanding what has been urged in favour of a rye pasture, it is scarcely worth the while of any farmer to attempt the cultivation of this grain who does not keep large numbers of ewes and lambs; for as the seed usually fetches a high price, every advantage attending the crop will be more than balanced by the superior charges in the cultivation, except in the instance abovementioned, where no expense should be spared to maintain the lambs in a thriving way, and to prevent their growing hard and sticky, as the butchers term it: for if lambs do once sink in flesh, it is beyond the art of man to restore them to their former thriving state.

Rye, which is designed to remain for a crop, may be fed till the latter end of March, at which time it begins to form its spindle, and seldom fails to produce ears in April, and becomes fit for the sickle a fortnight before the commencement of the wheat harvest.

ESSAY XXXIII.

On Fallowing.

THERE is not any part of agriculture which has occasioned more discuſsion and controversy among writers on husbandry, than this subject of fallowing. By many, it is said to be too little practised; and by others, too much so. By some, fallowing is condemned altogether; and by others, it is strongly recommended as the only method to destroy weeds, and meliorate and enrich the soil.

It is to be understood, that by a fallow, or summer-fallow, is meant land that bears no crop whatever for one year, and is well cultivated at proper intervals during the whole of that time; for if a crop of turnips, tares, or rye, for green food for sheep are produced, the land cannot be truly said to be a complete fallow.

When any kind of soil has borne three or four crops of corn in succeſsion, and is become full of weeds, a well made summer-fallow is certainly requisite, not only to destroy the weeds, but likewise to meliorate and invigorate the soil: it is the most certain cure, the speediest, and, in the end, the cheapest.

There are many kinds of land which, no doubt, may, by a proper succeſsion of crops, and a vigilant attendance with the hoe and hand-weeding, be kept tolerably clean from weeds for a long series of years, without the intervention of a summer-fallow. But it must be admitted, that there are other untoward soils, which all the art and industry of man cannot keep perfectly clean and in good order for any length of time, without a fallow: and there are other soils, which, if they could be kept tolerably free from weeds for a long time, might perhaps be more improved, and more profitably managed by a fallow every four or five years.

The soils that are easiest kept clean without a fallow, are the dry sandy loams, chalk, and gravel, which can be worked almost at any time, however wet; and readily admit the operation of drilling and hoeing at all seasons. Those which most require fallowing, are the stiff, wet soils, that will not admit the operation of the ploughs and harrows but at certain intervals, when the land is between wet and dry; opportunities of working such soils are frequently lost by bad seasons; in which case, weeds will undoubtedly increase, and it is then impoſsible to eradicate them but by making a good summer-fallow, or what is by some called a fallow-crop (viz.) cabbages, or winter tares; neither of which will perhaps turn to so good an account in the end as a complete summer-fallow.

Cold wet clays, even if they are tolerably clear from weeds, are subject, after two or three crops, to run together; and they then become so exceedingly stiff and cold, that, without the intervention of a summer-fallow to meliorate the soil, very poor crops only are to be expected; whereas, when a good fallow is made, an abundant crop of wheat, and two or three good crops of spring corn, are frequently produced. The constant practice of making summer-fallows in many counties for wheat, and sowing beans broad-cast after it, and then recurring to a fallow again, is most certainly a bad practice; and for landlords to compel their tenants to make a fallow every third year on all kinds of soils, as is the practice in some counties, is the height of absurdity; and it is no wonder that so many writers are found who condemn fallowing in toto, when they see so frequently the mischievous effects of fallowing under such management.

To make summer-fallows on light land, such as hazel, loam, sand, gravel, or chalk, to sow wheat upon, is extremely wrong; because experience teaches us, that wheat, under such management, is very subject to mildew, and to be root-fallen. All stiff soils, not full of manure, nor very rich, may with safety be sown with wheat on a fallow; and all light soils are a fine tilth for barley.

A good summer-fallow is the best preparation for a crop of clover; and a clover-lay, of all the tilths known, is the best for every other crop. But to sow clover on most soils, without a previous fallow, is a certain method of running the land to couch-graſs.

To make a good fallow, all kind of soils should be ploughed about five inches deep before Christmas; and as soon as the land is tolerably dry in March, it should be croſs-ploughed about six inches deep. Stiff soils must be left rough, until meliorated by rain, and then worked fine when between wet and dry; and all light soils immediately harrowed close after the plough, in order to promote the vegetation of seedling weeds, that they may be destroyed by subsequent ploughings, which must be repeated two or three times more, at intervals, as opportunities occur, during the months of May, June, and July; every time reducing the land fine immediately after each ploughing, while the land is moist, for the purpose before mentioned, of promoting the vegetation of weeds. Particular care should be taken not to touch the land either with the plough or harrows, when it is the least wet, as that only kneads it together, and creates more work to reduce it; besides locking up many of the seeds of weeds within the hard clods, and thereby preventing vegetation; by which such seeds are reserved for mischievous effects in the following crops of corn.

Some farmers never plough their fallows until they have finished their barley-sowing in the spring; and then, perhaps, not again until the land is overgrown with weeds. I have sometimes seen dung carried out, and laid in heaps, for spreading on such fallows, among green thistles and other weeds above the ground.

Fallows had better never be made at all, than be done in such a slovenly manner.

ESSAY XXXIV.

On Fruit Trees.

THIS is a subject in rural economy which ought to be much better understood than it is, in order to enable the planters to judge of the sorts proper to be planted, either as an article of pleasure, profit, or recreation; as much of the credit of the plantation must arise from judiciously choosing trees of the best, new, or middle-aged sorts, and not of the old worn-out varieties, which latter cannot, in the planting of orchards in common situations, even form valuable trees, and must end in the disappointment of the planter.

Engrafted fruits are not permanent. Every one of the least reflection must see that there is an eſsential difference between the power and energy of a seedling plant, and the tree which is to be raised from cuttings or elongations. The seedling is endued with the energies of nature, while the graft, or scion, is nothing more than a regular elongation, carried perhaps through the several repeatings of the same variety; whereas the seed, from having been placed in the earth, germinates and becomes a new plant, wherever nature permits like to produce like in vegetation; as in the oak, beech, and other mast-bearing trees. These latter trees, from each paſsing through the state of seedlings, are perfectly continued, and endued with the functions of forming perfect seeds for raising other plants by evolution, to the continuance of the like species.

This is not the case with engrafted fruits. They are doomed by nature to continue for a time, and then gradually decline, till at last the variety is totally lost, and soon forgotten, unleſs recorded by tradition, or in old publications.

Reason, with which Providence has most bountifully bleſsed some of our species, has enabled us, when we find a superior variety, to engraft it on a wilding stock, or to raise plants from layers and cuttings, or even to raise up the roots, and thus to multiply our sources of comfort and pleasure. This, however, does not imply that the multiplication of the same variety, for it is no more, should last for ever, unleſs the species will naturally arise from seed,

Nature, in her teaching, speaks in very intelligible language, which language is conveyed by experience and observation. Thus we see that among promiscuous seeds of fruits of the same sort, one or more may arise, whose fruits shall be found to poſseſs a value far superior to the rest in many distinguishable properties. From experience, also, we have obtained the power, by engrafting, of increasing the number of this newly-acquired tree, can change its country, give it to a friend, send it beyond the seas, or fill a kingdom with that fruit, if the natives are disposed so to do. Thus we seem to have a kind of creative power in our own hands.

From the attention lately paid to the culture of engrafted fruits, I hope we are now enabled to continue a supposed happily acquired tree, when we can find it, for a much longer duration than if such variety had been left in the state of unaſsisted nature; perhaps I may say for a duration as long again, or something more. After these sanguine expectations, I may reasonably be asked, to what does all this amount? for here there is no direct permanency—and why? The *why* is very obvious—because the kernels within the fruit, which are the seed of the plants for forming the next generation of trees, will not produce their like. I allow they may do so accidentally; but nothing more can be depended on.

For example, suppose we take *ten* kernels or pips of any apple raised on an engrafted stock: sow them, and they will produce ten different varieties, no two of which will be alike; nor will either of them closely resemble the fruit from whence the seeds were collected. The leaves also of those trees raised from the same primogenious or parent stock, will not actually be a copy of the leaves of any one of the varieties or family, to which each is connected by a vegetable consanguinity. I intentionally used the word actually, because a resemblance may be found, though not much of that is to be expected.

I beg that what has been last mentioned may not be taken as a discouragement to attempts for raising new varieties. I was obliged to speak very strongly, in order to place the culture upon its true foundation. I think it need not be observed, that there is no acquiring a new variety, but through the means of a seedling plant; and therefore whoever wishes to succeed must attempt it that way, or wait till others in their plantations may more fortunately produce it.

In choosing the seeds, that apple is most likely to produce the clearest and finest plants whose kernels are firm, large, and well ripened. The size of the fruit is not to be regarded; for large apples do not always ripen their fruit well, or rather for cider the small fruits are generally preferred for making the strongest, highest-flavoured liquor. And from what I have been able to collect in the cider-countries, it is there the opinion, that an apple something above the improved crab, promises the best succeſs. This advantage also attends the practice: if there are no valuable apples raised from that attempt, these wildings will make excellent stocks to engraft upon.

Gentlemen who actually employ themselves in attempting to acquire new varieties, should remember that they ought to select all the sets, from the bed of apple-quick, whose appearance is in the least degree promising, and plant them together, at such a distance as to allow each to produce its fruit, which will happen in about twelve, fifteen, or eighteen years. My friend Mr. Knight, who undoubtedly is the first in actual exertions for procuring these happily acquired new varieties, has had two plants bear fruit at six years old, and one at five. The cider countries have offered several premiums for procuring new varieties, and some with good effect. Premiums have been given both to Mr. Knight and Mr. Alban.

When the new variety is to be raised from a valuable admired apple, I should recommend the placing these seeds in a garden-pot, filled with mould from an old melon-bed; carrying the pot into a retired situation near the water, and giving attention to run the plants to as large a size as is convenient within eighteen months. With this view, the pot should be placed in the green-house the first winter; and when the plants are afterwards to be set out in the spots, they should not be placed under the drip of trees, or much exposed to the winds.

Two instances have been mentioned, the improved crab, and most admired apple; but prudence says, try all sorts, and something probably will arise; and the proceſs is attended with little trouble or expense to a person who constantly resides in the country: yet, after all this scientific care, the apple may want flavour, and be in other respects nothing better than a common wilding.

It is an undoubted fact, and worthy of observation, that all the different trees of the same variety have a wonderful tendency to similarity of appearance among themselves; and that the parent stock, and all engrafted from it, have a far greater resemblance to each other, than can be found in any part of the animal creation; and this habit does not vary to any extent of age.

As an encouragement in attempting to increase the number of new valuable fruits, we can prove that the Golden Pippin is native English. The Red-Streak, a seedling of Herefordshire, if not raised, yet was first brought into notice by Lord Scudamore, and was for a long time called Scudamore's Crab. The Stire Apple was accidentally raised in the

Forest of Dean, in Gloucestershire, and took the name of *Forest Stire.* The cider made from this apple was the strongest the country ever produced, according to any living record. The Haglo-crab, the best cider fruit now remaining, was discovered in the parish of Ecloe, on the banks of the Severn; and, about sixty or seventy years ago, many scions were taken from this tree by Mr. Bellamy, and engrafted on seedling stocks about Rofs. These are now grown old; and, to asscertain the age of the variety, I went with Charles Edwin, Esq. to Ecloes, in hopes of seeing the primogenious of this family. The proprietor of the estate acquainted Mr. Edwin that it had ceased to bear years ago, and was cut down. Those at Rofs are but poor bearers now, and I should suppose the variety must be 140 years old, though Marshal, who wrote in the year 1786, mentions these trees were prolific, and he supposes the sort to be about eighty years old; but, from present experience, it must be much more. The Tinton Squash-pear is of Gloucestershire; the Barland and Oldfield were near Ledbury, Herefordshire. The two last pears clearly bear the names of the two fields where they were raised. The Barland fell about six years ago, visibly from weight and longevity, which was supposed to have been about 200 years. There have been many other names of estimation handed down to us, though the realities are now totally worn out, and have ceased to exist. Can any better proof be desired, that engrafted fruits are not permanent, than the regret we feel for the loſs of these old valuable fruits.

To make this Eſsay as short as convenient, I have dwelt only on the Apple and Pear; yet all the engrafted fruits are under the same predicament of the seed not producing its like, and the offspring in time falling into a nothingneſs of growth and bearing, though that space of time must certainly depend on the natural longevity and hardineſs of the sort, soil, position, care, &c. All these are more fully expreſsed in the papers published in the different volumes of the Transactions of the Society of Arts, and the two volumes of the Orchardist, wherein the whole system is extended to form a rational culture for the management of Standard Fruits.

It should be remembered, that as I am now alluding to the state of actual permanency, fifty years are to be accounted as nothing;

and as often as we come to that point, we are compelled to resort to our first aſsertion, "That engrafted fruits are not permanent, "they being continued from elongations, and "not raised as a repetition of seeds." This is the only rational way as yet introduced of accounting for the loſs of the valuable old varieties of fruits. Should a better system be introduced, I shall readily adopt it; but this sufficiently answers the purposes of the planter.

Some years ago, from due investigation and thorough conviction, I propagated this principle; and it was published in the 17th volume of the Transactions of the Society of Arts, in the following words: "All the grafts taken "from this first tree, or parent stock, or any "of the descendants, will for some generations "thrive; but when this first stock shall, by "mere dint of old age, fall into actual decay, "a nihility of vegetation—the descendants, "however young, or in whatever situation "they may be, will gradually decline; and, "from that time, it would be imprudent, in "point of profit, to attempt propagating that "variety from any of them. This is the "dogma which must be received. I do not

" expect a direct aſsent, neither do I wish it, " for it should be taken with much reserve; " but it is undoubtedly true." These considerations should stimulate us in searching after new varieties, equal, or perhaps superior to those of which we regret the loſs.

Observe that, from the time the kernel germinates for apple-quick, should the plant be disposed to form a valuable variety, there will appear a regular progreſsive change, or improvement, in the organization of the leaves, until that variety has stood, and grown sufficient to bloſsom and come into full bearing; that is, from the state of infancy to maturity; and it is this and other circumstances by which the inquisitive eye is enabled to form the selection among those appearing likely to become valuable fruits. But from that time the new variety, or selected plant, compared with all the engraftments which may be taken from it, or any of them, these shall show a most undeviating sameneſs among themselves.

It is readily allowed, that the different varieties of fruits are easily distinguished from each other by many particulars, not only respecting their general fertility, and the form, size, shape, and flavour of the fruit, but also the manner of the growth of the tree, the thickneſs and proportion of the twigs, their shooting from their parent stem, the form, colour, and consistence of the leaf, and many other circumstances, by which the variety can be identified; and were it poſsible to engraft each variety upon the same stock, they would still retain their discriminating qualities, with the most undeviating certainty.

The proper conclusion to be drawn from the statement in the last paragraph, is this—that were any one to put the thought in practice on a full-grown, hardy, or crab stock, it would produce an excellent proof that engrafted fruits are not permanent. For if twenty different varieties were placed together, so that each might receive its nurture from the same stem, they would gradually die off in actual succeſsion, according to the age or state of health of the respective variety, at the time the scions were placed in the stock; and a discriminating eye, used to this buſineſs, would nearly be able to foretel the order in which each scion would actually decline. Should it also happen that two or three suckers from the wilding stock had been permitted to grow among the twenty grafts, such suckers, or wilding shoots, will continue, and make a tree after all the rest are gone. A further consequence would result from the experiment: among such a number of varieties, each of the free growers would starve the delicate, and drive them out of existence only so much the sooner. It must be observed, that this supposed stem is the foster-parent to the twenty scions, and real parent to the suckers; and those the least conversant with engrafted fruits know the advantage acquired from this circumstance. And here it is worth while remarking, that a Gascoyne, or wild cherry, will grow to twice the size that ever an engrafted cherry did.

By an experiment we have had in hand for five years, it will appear that the roots and stem of a large tree, after the first set of scions are exhausted or worn out, may carry another set for many years; and we suspect a third set, provided the engrafting is properly done, and the engrafter chooses a new variety. Now the Ribston Pippin, of Yorkshire, is the favourite, as being a free grower and good bearer, with fine fruit. This however may be certainly depended on, that when a new apple is raised from seed, if a scion were placed in a retired situation, and constantly cut down, as a stool in a copse-wood, and the apple never suffered to fulfil the intentions of nature in bearing fruit, the practitioners of the following ages may secure scions from that stool, to continue the variety much longer. Hence, though I have written as much as is in my power against permanency, yet I have taken some pains to aſsure the planters, that forecast, selection, pruning, cleanlineſs, and care, will make the orchards turn to more profit for the rising generations, than what they have done for the last hundred years.

To place the nature of varieties in its true light, for the information of the public, I must maintain, that the different varieties of the apple will, after a certain time, decline, and actually die away, and each variety, or all of the same stem or family, will lose their existence in vegetation; and yet it is a known fact, that after the debility of age has actually taken poſseſsion of any variety, it will yet thrive by being placed against a southern wall, and treated as wall-fruit. Who, however, can afford to raise cider at that expense, except as matter of curiosity, to prove, that when the vital principle in vegetation is nearly exhausted, a superior care and warmth will still keep the variety in existence some time longer?

It should be understood, that the external air of Britain is rather too cold for the delicate fruits, which is the reason why, in the Orchardist, I lay such a streſs on procuring warmth for the trees, by draining, shelter, and manure. It would be now lost time to attempt to recover the old varieties as an article of profit.

If I have not expreſsed myself, in this Eſsay on the nature of varieties, with so much clearneſs and conviction as might have been expected, it should be considered that it is an abstruse subject, very little understood, and requiring at first some degree of faith, observation and perseverance. The prejudices of mankind revolt against it. They are not disposed to allow the distinction of nature; and they imagine, that in the act of engrafting or multiplying they give new life, whereas it is only continuing the existence of the same tree, stick, or bud. Observe what I said before:—the seed of the apple, when placed in the earth, germinates, and unfolds itself into a new plant, which succeſsively paſses through the stages of infancy, maturity, and decay, like its predeceſsors. I might say, all created nature is similar in this respect; though, from the circumstance that varieties are much longer-lived than man, the plants have appeared to be poſseſsed of eternal powers of duration: nothing sublunary, however, which poſseſses either animal or vegetable life, is exempt from age and death.

Within the last twenty years I have travelled many hundred miles, and conversed with the most intelligent men in each country; and I now want to convince mankind, for no other reason than because it is their interest so to believe, that there is in creation an order of beings (engrafted fruits) so formed, that we have the power of multiplying a single variety, to whatever number of trees we please;—that the first set arises from a small seed;—that the next and descendant sets are propagated by engraftings, or from cuttings, layers, &c.;—and that although these trees may amount to millions, yet, on the death of the primogenious, or parent stock, merely from old age, or nihility of growth, each individual shall decline, in whatever country they may be, or however endued with youth and health. I say they shall gradually begin to decline; and in the course of time, or of centuries, to those who would prefer that expreſsion, the whole variety will scarcely have a single tree remaining to show what the fruit was. Let those who are not disposed to aſsent to this statement, ask themselves what is become of the old lost varieties? did they die, or did wicked men maliciously cut them up?

I, who am firmly convinced of the truth of what I have advanced on this subject, have no doubt but that the same would happen by engrafting on the Oak or Beech, if the mast raised from the engrafted tree did not produce the like; for there the question turns.

Is it not known, that the woodman, in setting out his sapling oaks, always selects new seedling plants, and never continues one upon an old stool; and that if he should so blunder, that tree, from the stool, will neither have the freedom of growth, nor the size or firmneſs of timber, equal to a new-raised plant.

I wish I could persuade my friends, that with the same attention with which the woodman acts, the planter is to raise his orchard from the young fruits which thrive in the neighbourhood, or are in health and full bearing in the country whence they are to be brought.

The fruit-grower should look to selection, cleanlineſs, and care. To me it is a circumstance perfectly indifferent, whether he is to use Mr. Forsyth's composition, Mr. Bulingham's boiled linseed oil, or my medication. I only maintain that the wounded parts of trees want something to destroy the insects and vermin, and heal the wood, from which the trees are kept in health.

ESSAY XXXV.

On Spring-Feed for Sheep.

GREAT inconvenience is frequently experienced by the want of food, from the time of the turnips being finished to that of the graſs being grown; in consequence of which, the cattle are almost entirely supported on the meadows till May-day, which is the usual time of breaking the pastures. Hence, hay-time being pushed back beyond its season, the crop is greatly injured; and the pastures, if old sward, by the time of breaking them, having obtained but little growth, and being fully stocked thus early, are prevented from getting a cover which might defend the roots from the scorching rays of the sun; and their produce also is thus much impaired

To remedy these inconveniences, nothing has yet occurred equal to the ruta-baga and winter-tares: the first is in high perfection a month later than turnips: the cultivation is the same for both; and though this new species of turnip may not grow to so large a size as those of the old one, yet will it produce as weighty and as valuable a crop, as each root is more ponderous in proportion to its size; and a greater number of them may be left upon the ground at the time of hoeing; and where too thin, they are found to bear transplanting, and the roots so transplanted, to be as large and forward as those which grew where originally sown. Sheep and cattle are not only fonder of them than of common turnips, but feed faster, and I think yield more tallow than when fed on common turnips: pigs thrive full as well on them as on potatoes, and horses will eat them freely.

Winter-tares, if sown early, will be found very valuable for the sheep-stock, to succeed the ruta-baga during the month of May. After these have been pastured for some time, they may either be suffered to stand for a crop of seed, or eaten clean off; and if the land be free from couch, it may be ploughed up for a crop of turnips.

By sowing rye-graſs with the crop of corn the year preceding a dead fallow, much valuable spring food may be obtained until near

Midsummer, time enough for the land to be ploughed.

Great advantage will be found from freeing part of the graſs-land early in autumn, which will be found practicable, either by cultivating rape or turnips, to be eat off in time to sow the land with wheat, or by the purchase of such elsewhere. This graſs-land should continue to be laid up during winter; and the cover which it has acquired in autumn, will produce a very early growth in spring. By this, and the other methods here recommended, greater plenty of food will be gained from Lady-day to Midsummer, than in any other part of the year, and plenty created throughout the whole of it.

ESSAY XXXVI.

By means of the following Table, drawn up by my learned friend Dr. Falconer, of Bath, the Botanist will be enabled to discover if any particular plant, the Linnæan name of which is known, be one of those with which the Greeks were acquainted; for though the Table may not be of use to the generality of my readers, it cannot but be highly acceptable to those medical Agriculturists, who, from the nature of their profeſsion, are expected to be acquainted with all the plants known to the ancients.

A. H.

AC

ACANTHUS Dioscoridis. Vide Ακανθα, ἡ Ερπακανθα.
Acanthus mollis. Ακανθα, ἡ Ερπακανθα.
Acanthus spinosus. Ακανθα αγρια.
Acer campestre. Σφενδαμνος. Sp. 1.
Acer platanoïdes. Σφενδαμνος ζυγια.
Acer pseudo-platanus. Σφενδαμνος κλινοτροχος.
Achillæa Ageratum. Αγηρατον.
Achillæa millefolium. Στρατιωτης Χιλιοφυλλος.
Achillæa nobilis. Αχιλλειον.
Achillæa Ptarmica. Πταρμικη.
Achillæa tomentosa. Στρατιωτης Χιλιοφυλλος.
Aconitum Cammarum. Ακονιτον ϖαρδαλιαγχες.
Aconitum lycoctonum. Ακονιτον λυκοκτονον.

AL

Acorus Calamus. Ακορος.
Adiantum Capillus Veneris. Αδιαντον μελαν.
Adonis æstivalis. Φλοξ.
Agaricus Androsaceus. Ανδροσακες.
Agrimonia Eupatoria. Ευπατωριον.
Agrostemma coronaria. Λυχνις ϛεφανωματικη.
Alcea rosea. Μαλαχη κηπωτη.
Alisma Damasonium. Αλισμα.
Allium Ampeloprasum. Πρασον. Sp. 2.
Allium Ascalonicum. Κρομμυον.
Allium Cepa. Κρομμυον.
Allium magicum. Μωλυ.
Allium Moly. Μωλυ.
Allium Porrum. Πρασον κεφαλωτον.

AM

Allium sativum.	Μωλυζα.
Allium sativum.	Σκοροδον ημερον.
Allium scorodoprasum.	Σκοροδοπρασον.
Allium subhirsutum.	Μωλυ.
Allium Victorialis.	Σκοροδον αγριον.
Aloë perfoliata.	Αλοη.
Alsine media.	Αλσινη.
Althæa cannabina.	Καναβις αγρια.
Althæa officinalis.	Αλθαια.
Alyſsum clypeatum.	Αλυσσον.
Amaranthus Blitum.	Βλιτον.
Amaryllis lutea.	Λειριον ετερον.
Ambrosia maritima.	Αμβροσια.
Amomum Cardamomum.	Καρδαμωμον.
Amomum grana Paradisi.	Καρδαμωμον.
Amomum Zingiber.	Ζιγγιβερις.
Amygdalus communis.	Αμυγδαλη.

AN

Amygdalus Persica.	Περσικη μηλεα.
Anacyclus Valentinus.	Βουφθαλμον.
Anagallis arvensis.	Κορκορος.
Anagallis Monelli.	Αναγαλλις. Sp. 1.
Anagyris fœtida.	Αναγυρις.
Anastatica Hierochuntea.	Αμωμις.
Anchusa tinctoria.	Αγχουσα αλκιβιαδιον.
Andropogon Ischæmum.	Ισχαιμος.
Andropogon Nardus.	Καλαμος.
Andropogon Schœnanthus.	Σχοινος.
Anemone Appennina.	Ανεμωνη ημερος.
Anemone nemorosa.	Ανεμωνη λειμωνια.
Anemone sylvestris.	Ανεμωνη αγρια.
Anethum fœniculum.	Μαραθρον.
Anethum graveolens.	Ανηθον.
Anthemis Cotula.	Παρθενιον λεπτοφυλλον.
Anthemis Pyrethrum.	Πυρεθρον.

AR

Anthericum ramosum.	Φαλαγγιον.
Anthyllis hermania.	Κυτισος.
Antirrhinum Elatine.	Ελατινη.
Antirrhinum minus.	Αντιρρινον.
Antirrhinum Orontium.	Οροντιον.
Antirrhinum spurium.	Ελατινη.
Antirrhinum linaria.	Οσυρις.
Apium graveolens.	Ελαιοσελινον.
Apium petroselinum.	Σελινον.
Apluda Zeugites.	Ζευγιτης.
Apluda Zeugites.	Ευνυχιας.
Aquilegia vulgaris.	Ισοπυρον.
Arbutus Andrachne.	Ανδραχνη.
Arbutus unedo.	Κομαρος.
Arbutus Uva Ursi.	Ιδαια ριζα.
Arctium Lappa.	Αρκτιον.
Aristolochia Clematitis.	Αριστολοχια κληματιτις.

AR

Aristolochia longa.	Αριστολοχια μακρα.
Aristolochia rotunda.	Αριστολοχια στρογγυλη.
Arnica scorpioïdes.	Ακονιτον παρδαλιαγχες.
Artedia squamata.	Γιγγιδιον.
Artemisia Abrotonum.	Αβροτονον αρρεν.
Artemisia Absinthium.	Αψινθιον. Sp. 1.
Artemisia maritima.	Αψινθιον θαλασσιον.
Artemisia vulgaris.	Αρτεμισια. Sp. 1.
Arum Arisarum.	Αρισαρον.
Arum Colocasia.	Βολβος.
Arum Colocasia	Κυαμος Αιγυπτιος.
Arum dracunculus	Δρακοντιον.
Arum maculatum.	Αρον.
Arundo Calamagrostis.	Καλαμαγρωστις.
Arundo donax.	Δοναξ.
Arundo phragmites.	Καλαμος χαρακιας.
Arundo phragmites.	Φραγμιτης.

AS

Asarum Europæum. Ασαρον.
Asclepias Vincetoxicum. Ασκληπιας.
Asparagus acutifolius. Ασπαραγος ϖετραιος.
Asparagus officinalis altilis. Ασπαραγος. Sp. 1.
Asparagus officinalis maritimus. Ασπαραγος ελειος.
Asphodelus luteus. Αμαρακος.
Asphodelus luteus. Ιφυον.
Asphodelus ramosus. Ασφοδελος.
Asplenium Adiantum nigrum. Αδιαντον μελαν.
Asplenium Ceterach. Ασπληνον.
Asplenium Hemionitis. Ημιονιτις.
Asplenium Ruta muraria. Αδιαντον λευκον.
Asplenium Trichomanes. Τριχομανες.
Asplenium Scolopendrium. Φυλλιτις.
Aster Amellus. Αστερισκος.
Aster Tripolium. Τριπολιον.

AV

Astragalus Cicer. Ερεβινθος αγριος.
Astragalus Glaux. Γλαυξ.
Astragalus Onobrychis. Ονοβρυχις.
Astragalus Syriacus. Αστραγαλος.
Astragalus Tragacantha. Ποτηριον.
Astragalus Tragacantha. Τραγακανθα.
Athamanta cervaria. Δαυκος. Sp. 2.
Athamanta Cretensis. Δαυκος Κρητικος.
Athamanta Libanotis. Λιβανωτις ακαρπος.
Athamanta Meum. Μηον Αθαμαντικον.
Athamanta Oreoselinum. Ορεοσελινον.
Atriplex halimus. Αλιμος.
Atriplex hortensis. Ατραφαξις κηπευτον.
Atropa Belladonna. Στρυχνον μανικον.
Atropa Belladonna. Μανδραγορη.
Atropa Mandragora. Μανδραγορη.
Avena fatua. Αιγιλωψ.

Avena sativa. Βρωμος.

B

BALLOTA nigra. Βαλλωτη.
Berberis vulgaris. Κολουτεα περι την Ιδην.
Berberis vulgaris. Οξυακανθα.
Berberis vulgaris. Οξυακανθος.
Beta vulgaris rubra. Τευτλον.
Betonica officinalis. Βετονικη.
Betonica officinalis. Κεϛρον.
Betonica officinalis. Βρεταννικη.
Betula alba Σημυδα.
Betula Alnus. Κληθρα.
Borago officinalis. Βυγλωσσον.
Braſsica Eruca. Ευζωμον.
Braſsica Erucastrum. Ευζωμον αγριον.

Braſsica Eruca. Ευζωμον. Sp. 1.
Braſsica Napus. Βυνιας.
Braſsica oleracea. Ραφανος οὐ λειοφυλλος.
Braſsica oleracea capitata. Κραμβη ημερος.
Braſsica oleracea Cotrytis. Ραφανος. Theoph. Spec. 3tia.
Braſsica oleracea Sabauda. Ραφανος οὐ λειοφυλλος.
Braſsica oleracea viridis β. Ραφανος λειοφυλλος.
Braſsica Rapa. Γογγυλη.
Bromus sterilis. Βρωμος.
Bryonia alba. Αμπελος λευκη.
Bubon Macedonicum. Πετροσελινον.
Bunium bulbocastanum. Βυνιον.
Bupleurum fruticosum. Σεσελι Αιθιοπικον.
Bupleurum rigidum. Βυπλευρον.
Buxus sempervirens. Πυξος.

C

CACHRYS Libanotis. Λιβανωτις.
Calendula officinalis. Κλυμενον.
Caltha palustris. Αφια.
Campanula Erinus. Ερινος.
Campanula Medium. Μηδιον.
Cannabis sativa. Καναβις ημερα.
Capparis spinosa. Καππαρις.
Capsicum annuum. Κιρκαια.
Cardamine bellidifolia. Σισυμβριον ετερον.
Cardamine pratensis. Σισυμβριον ετερον.
Carduus Casabonæ. Ακαρνα.
Carduus crispus. Κιρσιον.
Carduus diſsectus. Κιρσιον.
Carduus eriophorus. Ακανθα Αραβικη.

Carduus Marianus. Σιλυβον.
Carduus nutans. Ονοπυξος.
Carduus Syriacus. Ακανος.
Carex Pseudo-Cyperus. Ψευδοκυπειρος.
Carlina acaulis. Χαμαιλεων.
Carlina vulgaris. Ακορνα.
Carlina vulgaris. Ατρακτυλις.
Carpinus betulus. Οστρυς.
Carpinus Ostrya. Οστρυς.
Carthamus corymbosus. Χαμαιλεων.
Carthamus tinctorius. Κνικος ημερος.
Carum Carvi. Καρος.
Caryophyllus aromaticus. Κωμακον.
Caucalis grandiflora. Καυκαλις.
Celtis australis. Λωτος. (arbor.)
Centaurea benedicta. Κνικος αγρια.
Centaurea calcitrapa. Ιπποφαιστον.

CH

Centaurea calcitrapa. Μυακανθος.
Centaurea calcitrapa. Πικρις.
Centaurea calcitrapa. Φυλλακανθα.
Centaurea Centaureum. Κενταυριον.
Centaurea Crocodylium. Κροκοδιλιον.
Centaurea Salmantica. Στοιβη.
Centaurea Solstitialis. Λευκακανθα.
Centaurea Stœbe. Στοιβη.
Ceratonia siliqua. Κερατια.
Cercis siliquastrum. Κερκις.
Cercis siliquastrum. Κολυτεα ϖερι Λιπαραν.
Cerinthe major. Κηρινθος.
Chærophyllum bulbosum. Ολοκωνιτης.
Chamærops humilis. Φοινιξ. Sp. 2.
Cheiranthus Cheiri. Λευκοιον.
Chelidonium glaucum. Μηκων κερατιτις.
Chelidonium majus. Χελιδονιον.

CI

Chenopodium album. Ατραφαξις αγριον.
Chenopodium Botrys. Βοτρυς.
Chenopodium Scoparia. Οσυρις.
Chondrilla juncea. Χονδριλλη.
Chrysanthemum coronarium. Χρυσανθεμον.
Chrysocoma Linosyris. Οσυρις.
Chrysocoma Linosyris. Χρυσοκομη.
Cicer Arietinum Ερεβινθος αγριος.
Cichorium Endivia. Σερις.
Cichorium Intybus. Πικρις.
Cinara Cardunculus. Κακτος.
Cinara Scolymus. Σκολυμος.
Cistus Helianthemum. Ελενιον Αιγυπτιον.
Cistus ladaniferus. Κιστος ληδον.
Cistus pilosus. Κιστος αρρην.
Cistus salvifolius. Κιστος θηλεια.
Citrus Medica. Μηδικη μηλεα.

CO

Clematis Vitalba. Ατραγενη.
Clematis Vitalba. Κληματιτις.
Clematis Viticella. Ποθος Φρυγιος.
Clinopodium vulgare. Κλινοποδιον.
Cnicus Acarna. Ακαρνα.
Cochlearia Armoracia. Θλασπι ετερον.
Cochlearia Armoracia. Ραφανις. Sp. 2
Cochlearia Draba. Δραβη.
Coïx lacryma Jobi. Κοϊξ.
Coïx lacryma Jobi. Λιθοσπερμον.
Colchicum Autumnale. Κολχικον.
Colutea arborescens Κολυτεα περι Λιπαραν.
Conium maculatum. Κωνειον.
Convallaria Maialis. Οιναnθη.
Convallaria multiflora. Πολυγονατον.
Canvallaria Polygonatum. Πολυγονατον.
Convolvulus arvensis. Ελξινη.

CR

Convolvulus Soldanella. Κραμβη θαλασσια.
Convolvulus Scammonia. Σκαμμωνια.
Convolvulus sepium. Σμιλαξ λεια.
Cordia Myxa. Ομαμαξις.
Coriandrum sativum. Κοριον.
Coris Monspeliensium. Συμφυτον. Sp. 1.
Cornus mas. Κρανεια.
Cornus sanguinea. Θηλυκρανεια.
Coronilla juncea. Πολυγαλον.
Coronilla securidaca. Ηδυσαρον.
Corylus avellana. Καρυα.
Costus Arabicus. Κοστος.
Cotyledon umbilicus. Κοτυληδων. Sp. 1.
Cratægus Aria. Αρια.
Cratægus Aronia. Μεσπιλος Αρωνια.
Cratægus Azarolus. Μεσπιλος Αρονια.
Cratægus Oxyacantha. Μεσπιλος ανθηδονοειδης.

CY

Cratægus Oxyacantha.	Οξυακανθα
Cratægus torminalis.	Κραταιγος.
Crepis Dioscoridis.	Ιερακιον μεγα.
Crithmum maritimum.	Κριθμον.
Crocus sativus.	Κροκος.
Croton tinctorium.	Ηλιοτροπιον μικρον.
Cucumis Colocynthus.	Κολοκυνθις.
Cucumis sativus.	Σικυς ημερος.
Cucurbita Citrullus.	Πεπων.
Cucurbita Pepo.	Πεπων.
Cuminum Cyminum.	Κυμινον.
Curcuma rotunda.	Κυπειρος Ινδικος.
Cupreſsus semper-virens.	Κυπαρισσος.
Cuscuta Europæa.	Επιθυμον.
Cycas Circinalis	Φοινιξ. Sp. 3.
Cyclamen Europæum.	Κυκλαμινος.
Cynanchum erectum.	Αποκυνον.

DA

Cynogloſsum Apenninum.	Κηρινθος.
Cynogloſsum officinale.	Κυνογλωσσον.
Cyperus esculentus.	Ολοκωνιτης.
Cyperus esculentus.	Μαλιναθαλλη.
Cyperus longus.	Κυπειρος. Sp. 1.
Cyperus Papyrus.	Παπυρος.
Cyperus Papyrus.	Σαρι.
Cyperus Papyrus.	Φλεως.

D

DAPHNE Alpina.	Χαμελαια.
Daphne Cneorum.	Κνεωρον λευκον.
Daphne Gnidium.	Θυμελαια.
Daphne Laureola.	Δαφνοειδες.
Daphne Mezereum.	Χαμαιδαφνη.
Daphne Thymelæa.	Θυμελαια.

GE

Filago Germanica. Γναφαλιον.
Filago Leontopodium. Λεοντοποδιον.
Fraxinus excelsior. Μελια υψηλη.
Fraxinus ornus. Μελια ταπεινοτερα.
Fucus Cartilagineus. Φυκος ϑαλασσιον.
Fucus vesiculosus. Δρυς εναλια.
Fumaria officinalis. Καπνος.

G

GALEOPSIS Galeobdolon. Γαλιοψις.
Gallium Aparine. Απαρινη.
Gallium verum. Γαλλιον.
Gentiana Centaurium. Κενταυριον μικρον.
Gentiana Centaurium. Παναξ λεπτοφυλλον.
Gentiana lutea. Γεντιανη.

GY

Geranium rotundifolium. Γερανιον φυλλα μαλαχης εμφερον.
Geranium tuberosum. Γερανιον φυλλον εχον ανεμωνης.
Gladiolus communis. Ξιφιον.
Glaux maritima. Γλαυξ.
Glecoma hederacea. Χαμαικισσος.
Globularia Alypum. Αλυπον.
Globularia Alypum. Εμπετρον.
Glycyrrhiza echinata. Γλυκυρριζα.
Glycyrrhiza glabra. Σκυθικη ριζα.
Gnaphalium orientale. Χρυσοκομη.
Gnaphalium Stœchas. Ελιχρυσον.
Goſsypium arboreum. Δενδρον εριοφορον.
Goſsypium herbaceum. Ξυλον.
Guilandina Moringa. Βαλανος μυρεψικη.
Gypsophila Struthium. Στρυθιον.

EU

Erysimum cheiranthus. Ερυσιμον.
Erysimum officinale. Ερυσιμον.
Erythronium dens Canis. Κρινον ϖορφυρον.
Euonymus Europæus tenuifolius. Ευωνυμος.
Euonymus Europæus tenuifolius. Τετραγωνια.
Euphorbia amygdaloïdes. Τιθυμαλλος. Sp. 1.
Euphorbia Apios. Απιος.
Euphorbia Chamæsyce. Χαμαισυκη.
Euphorbia cypariſsias. Τιθυμαλλος. Sp. 5.
Euphorbia dendroïdes. Τιθυμαλλος. Sp. 6.
Euphorbia helioscopia. Τιθυμαλλος. Sp. 4.
Euphorbia Lathyris. Λαθυρις.
Euphorbia myrsinites. Τιθυμαλλος. Sp. 2.
Euphorbia officinarum. Ευφορβιον.
Euphorbia paralias. Τιθυμαλλος. Sp. 3.
Euphorbia Peplis. Πεπλις.
Euphorbia Peplus. Πεπλος.

FI

Euphorbia Pithyusa. Πιτυȣσα.
Euphorbia platyphylla. Τιθυμαλλος. Sp. 7.
Europæa Epithymum. Επιθυμον.
Excæcaria Agallocha. Αγαλλοχον.

F

FAGUS Castanea. Καϛανα.
Fagus Castanea. Καρυον Ευβοϊκον.
Fagus sylvatica. Οξυα.
Ferula Aſsa fœtida. Σιλφιον.
Ferula Ferulago. Ναρθηκιον.
Festuca elatior. Καλαμαγρωϛις.
Festuca fluitans. Αγρωϛις ϖοταμιος.
Ficus Carica. Συκη. Sp. 1.
Ficus Indica. Συκη Ινδικη.
Ficus Sycomorus. Συκομορον.

GE

Filago Germanica.	Γναφαλιον.
Filago Leontopodium.	Λεοντοποδιον.
Fraxinus excelsior.	Μελια υψηλη.
Fraxinus ornus.	Μελια ταπεινοτερα.
Fucus Cartilagineus.	Φυκος θαλασσιον.
Fucus vesiculosus.	Δρυς εναλια.
Fumaria officinalis.	Καπνος.

G

GALEOPSIS Galeobdolon.	Γαλιοψις.
Gallium Aparine.	Απαρινη.
Gallium verum.	Γαλλιον.
Gentiana Centaurium.	Κενταυριον μικρον.
Gentiana Centaurium.	Παναξ λεπτοφυλλον.
Gentiana lutea.	Γεντιανη.

GY

Geranium rotundifolium.	Γερανιον φυλλα μαλαχης εμφερον.
Geranium tuberosum.	Γερανιον φυλλον εχον ανεμωνης.
Gladiolus communis.	Ξιφιον.
Glaux maritima.	Γλαυξ.
Glecoma hederacea.	Χαμαικισσος.
Globularia Alypum.	Αλυπον.
Globularia Alypum.	Εμπετρον.
Glycyrrhiza echinata.	Γλυκυρριζα.
Glycyrrhiza glabra.	Σκυθικη ριζα.
Gnaphalium orientale.	Χρυσοκομη.
Gnaphalium Stœchas.	Ελιχρυσον.
Goſsypium arboreum.	Δενδρον εριοφορον.
Goſsypium herbaceum.	Ξυλον.
Guilandina Moringa.	Βαλανος μυρεψικη.
Gypsophila Struthium.	Στρουθιον.

H

HEDERA helix. Κισσος.
Hedysarum Onobrychis. Ονοβρυχις.
Heliotropium Europæum. Ηλιοτροπιον μεγα.
Helleborus niger. Ελλεβορος μελας.
Hemerocallis flava. Ημεροκαλες.
Hemerocallis fulva. Ημεροκαλλες.
Heracleum Panacis. Πανaξ Ηρακλειον.
Heracleum Sphondylium. Σφονδυλιον.
Hesperis matronalis. Εσπερις.
Hibiscus palustris. Σιδη.
Hippuris vulgaris. Πολυγονον θηλυ.
Hordeum vulgare. Κριθη.
Hyacinthus comosus. Ποθος. Sp. 1.
Hyacinthus comosus. Υακινθος.

Hyoscyamus albus. Υοσκυαμος. Sp. 3.
Hyoscyamus aureus. Υοσκυαμος. Sp. 2.
Hyoscyamus niger. Υοσκυαμος. Sp. 1.
Hypecoüm procumbens. Υπηκοον.
Hypericum Androsæmum. Ανδροσαιμον.
Hypericum Ascyrum. Ασκυρον.
Hypericum Coris. Κορις
Hypericum perforatum. Υπερικον.
Hypericum quadrangulum. Ασκυρον.
Hyſsopus officinalis. Υσσωπος.

I

IATROPHA Manihot. Αρακιδνα.
Inula dysenterica. Κονυζα. Sp. 3.
Inula helenium. Ελενιον.
Iris fœtidiſsima. Ιρις αγρια.

Iris fœtidiſsima. Ξυϱις.
Iris florentina. Ιϱις Λιϐυκη.
Iris Sisyrinchium. Σισυϱιγχιον.
Iris Xiphium. Ξιφιον.
Isatis tinctoria. Ισατις. Sp. 1.
Ixia bulbocodium. Σισυϱιγχιον.

J

JUGLANS regia. Καϱυα.
Juniperus regia. Καϱυον Ευϐοïκον.
Juncus acutus. Σχοινος. Sp. 2.
Juncus effusus. Σχοινος. Sp. 1.
Juniperus communis. Αϱκευθος μικϱα, και μεγαλη.
Juniperus Lycia. Κεδϱος Λυκια.
Juniperus Oxycedrus. Οξυκεδϱος.

Juniperus Phœnicea. Κεδϱος φοινικη.
Juniperus Sabina. Βϱαθυς ομοιος κυπαϱισσῳ.
Juniperus Sabina β. Βϱαθυς ομοιος μυϱικῃ.
Juniperus Sabina. Θυον.

L

LACTUCA perennis. Απατη.
Lactuca sativa. Θϱιδαξ ημεϱος.
Lagoëcia Cuminoïdes. Κυμινον αγϱιον.
Lactuca Scariola. Θϱιδαξ αγϱια.
Lagurus ovatus. Αλωπεκυϱος.
Laminum purpureum. Γαλιοψις.
Laserpitium Chironium. Πaναξ Συϱιακον.
Laserpitium Gallicum. Σιλφιον.
Laserpitium Siler. Λιγυστικον.
Lathræa squamaria. Αιγολεθϱος.

LE

Lathyrus amphicarpos.	Αρακιδνα.
Lathyrus aphaca.	Αφακη.
Lathyrus Clymenum.	Κλυμενον.
Lathyrus sativus.	Λαθυρος.
Lavandula Stœchas.	Στιχας.
Laurus Caſsia.	Κασσια.
Laurus Cinnamomum.	Κινναμωμον.
Laurus nobilis.	Δαφνη λεπτοφυλλος.
Laurus Persea.	Περσεα.
Ledum palustre.	Χαμαιλευκη.
Leontice Chrysogonum.	Χρυσογονον.
Leontice Leontopetalon.	Λεοντοπεταλον.
Leontodon Autumnale.	Ιερακιον μικρον.
Lootodon bulbosum.	Περδικιον.
Leontodon bulbosum.	Χονδριλλη.
Leontodon Taraxacum.	Αφακη.
Leontodon Taraxacum.	Σερις αγρια.

LO

Leonurus Cardiaca.	Πρασιον.
Lepidium Iberis.	Ιβερις.
Lepidium latifolium.	Λεπιδιον.
Lepidium sativum.	Καρδαμον.
Leucoium vernum.	Λευκοιον.
Lichen plicatus.	Βρυον επι δενδρων.
Lichen fuciformis.	Φυκος θαλασσιον.
Ligusticum Austriacum.	Σεσελι Πελοποννησιακον.
Ligusticum Levisticum.	Αθαμαντα καρπιμος.
Ligusticum Pelopponesiacum.	Σεσελι Πελοποννησιακον.
Ligustrum vulgare.	Κυπρος.
Lilium bulbiferum.	Κρινον πορφυρον.
Lilium candidum.	Λειριον.
Linum usitatiſsimum.	Λινον.
Lithospermum officinale.	Λιθοσπερμον.
Lolium perenne.	Φοινιξ. (herba.)

MA

Lolium temulentum. Αιρα.
Lolium temulentum. Ζιζανιον.
Lonicera Alpigena. Συκη ϖερι την Ιδην.
Lonicera periclymenum. Περικλυμενον.
Lupinus albus. Θερμος ημερος.
Lupinus varius. Θερμος αγριος.
Lycium barbarum. Λυκιον.
Lychnis Chalcedonica. Λυχνις.
Lychnis Chalcedonica. Ποθος ετερος.
Lycoperdon Tuber. Υδνον.
Lysimachia Ephemerum. Εφημερον.
Lysimachia vulgaris. Λυσιμαχιον.

M

MALVA Alcea. Αλκεα.
Malva rotundifolia. Μαλαχη χερσαια.

ME

Marchantia polymorpha. Λειχην.
Marrubium Alyſson. Αλυσσον.
Marrubium pseudo-dictamnus. Δικταμνος ψευδοδικταμνος.
Marrubium vulgare. Πρασιον. Sp. 2.
Marsilea quadrifolia. Λεμνα.
Marsilea quadrifolia. Φακος ὁ επι των τελματων.
Matricaria Chamomilla. Ανθεμις.
Matricaria Chamomilla. Ανθεμον.
Matricaria Parthenium. Παρθενιον.
Medicago arborea. Κυτισος.
Medicago sativa. Μηδικη.
Melampyrum arvense. Μελαμπυρον.
Melampyrum pratense. Κραταιογονον
Meliſsa Calamintha. Καλαμινθη ἡ εοικεν Ηδυοσμῳ.

Meliſsa Cretica. Καλαμινθη ορεινοτερα.
Meliſsa Nepeta. Καλαμινθη ἡ γληχωνι εοικε.
Meliſsa officinalis. Μελισσοφυλλον.
Mentha aquatica. Σισυμϐριον. Sp. 1.
Mentha arvensis. Πολυκνημον.
Mentha pulegium. Γληχων.
Mentha sativa. Ηδυοσμος ημερος.
Mentha sylvestris. Ηδυοσμος αγριος.
Mercurialis annua. Λινοζωσις.
Mercurialis tomentosa. Φυλλον.
Mespilus Amelanchier. Αμαμηλις.
Mespilus Germanica. Μεσπιλος Επιμηλις.
Mespilus Pyracantha. Οξυακανθα.
Mimosa Nilotica. Ακανθα Αιγυπτια-Ακακια Αιγυπτια.
Momordica Elaterium. Σικυς αγριος.
Morus nigra. Μορεα.

Musa paradisiaca. Φοινιξ. Sp. 4.
Myagrum sativum. Μυαγρον.
Myosotis scorpioïdes. Μυος ωτα.
Myristica officinalis. Κωμακον.
Myristica officinalis. Χρυσοϐαλανος.
Myriophyllum spicatum. Μυριοφυλλον.
Myrtus communis. Μυρσινη.
Myrtus Gala. Μυρικη ημερος.

N

NARCISSUS Bulbocodium. Βολϐουκωδιον.
Narciſsus poëticus. Ναρκισσος.
Narciſsus Pseudo-Narciſsus. Βολϐουκωδιον.
Nardus Gangitis. Ναρδος.
Nerium Oleander. Νηριον.
Nigella arvensis. Μελανθιον.

Nymphæa alba.	Νυμφαια. Sp. 1.
Nymphæa lotus.	Λωτος Αιγυπτιος.
Nymphæa lutea.	Νυμφαια ετερα.

O

OCYMUM Basilicum.	Ωκιμον.
Oenanthe pimpinelloides.	Οινανθη.
Olea Europæa.	Αιθιοπικη Ελαια.
Olea Europæa.	Ελαια ημερος.
Ononis Antiquorum.	Ανωνις.
Ononis spinosa.	Ανωνις.
Onopordium Acanthium.	Ακανθιον.
Onosma echioides.	Αγχουσα ονοκλεια.
Onosma echioides.	Ονοσμα.
Ophrys insectifera.	Ορχις σεραπιας.
Orchis militaris.	Ορχις. Sp. 1.

Origanum Dictamnus.	Δικταμνος Κρητικος.
Origanum heracleoticum.	Οριγανος Ηρακλεωτικη.
Origanum Majorana.	Μαρον.
Origanum Onites.	Οριγανος Ονιτις.
Origanum vulgare.	Οριγανος αγρια.
Ornithogalum Arabicum.	Ορνιθογαλον.
Ornithopus scorpioides.	Τηλεφιον.
Orobanche major.	Οροβαγχη.
Oryza sativa.	Ορυζα.
Osmunda spicans.	Λογχιτις ετερα.

P

PÆONIA offic: fœminea.	Παιονια θηλεια.
Pæonia offic: mascula β.	Παιονια αρρην.
Panicum Italicum.	Ελυμος.

PH

Panicum Italicum. Μελινος.
Panicum miliaceum. Κεγχρος.
Papaver Argemone. Αργεμωνη.
Papaver Rhœas. Μηκων αγριωτερα.
Papaver Rhœas. Μηκων Ροιας.
Papaver somniferum. Μηκων κηπευτη.
Parietaria officinalis. Ελξινη. Dioſc. IV. 86.
Parnaſsia palustris Αγρωστις εν Παρνασσῳ.
Pastinaca Opoponax. Πανακ Ηρακλειον.
Pastinaca sativa. Ελαφοβοσκον.
Peucedanum officinale. Πευκεδανον.
Phellandrium aquaticum. Μυριοφυλλον.
Phœnix dactylifera. Φοινιξ. Sp. 1.
Phalaris Canariensis. Φαλαρις.
Phleum pratense. Στελεφυρος.
Phaseolus vulgaris. Σμιλαξ κηπαια.

PI

Phlomis fruticosa. Φλομος. Sp. 2.
Phlomis lychnitis. Φλομος. Sp. 3.
Phillyrea latifolia. Φιλλυρεα.
Physalis somnifera. Στρυχνος. Sp. 3.
Physalis Alkekengi. Στρυχνος. Sp. 2.
Pimpinella Anisum. Ανισον.
Pimpinella peregrina. Δαυκος. Sp. 3.
Pinus Abies. Ελατη θηλεια
Pinus Abies. Πιτυς.
Pinus Cedrus. Κεδρος Συριακη.
Pinus picea. Ελατη αρρην.
Pinus pinea. Πευκη ημερος.
Pinus sylvestris. Πευκη αγρια.
Pinus sylvestris β. Πευκη ϖαραλια.
Piper nigrum. Πεπερι μελαν.
Piper longum. Πεπερι μακρον.
Pistacia vera. Πιςακια.

PI.

Pistacia lentiscus.	Σχινος.
Pistacia terebinthus.	Τερμινθος.
Pistia Stratiotes.	Στρατιωτης ϖοταμιος.
Pisum arvense.	Οχρος ημερος.
Pisum arvense.	Πισον μικρον.
Pisum Ochrus.	Οχρος αγριος.
Pisum sativum.	Πισον μεγα.
Plantago Afra.	Ψυλλιον.
Plantago albicans.	Ολεσιον.
Plantago Coronopus.	Κορωνοϖυς.
Plantago Cretica.	Καταναγχη.
Plantago Cynops.	Κυνοψ.
Plantago lanceolata.	Αρνογλωσσον μικρον.
Plantago major.	Αρνογλωσσον μειζον.
Plantago psyllium.	Κυνοψ.
Plantago psyllium.	Ψυλλιον.
Platanus orientalis.	Πλατανος.

PO

Poa pratensis.	Ποα.
Polycarpon tetraphyllon.	Παρωνυχια.
Polygala vulgaris.	Ονοβρυχις.
Polygala vulgaris.	Πολυγαλα.
Polygonum aviculare.	Πολυγονον.
Polygonum Fagopyrum.	Ερυσιμον.
Polygonum Hydropiper.	Υδροπεπερι.
Polypodium Dryopteris.	Δρυοπτερις.
Polypodium Lonchitis.	Λογχιτις.
Polypodium mas.	Πτερις.
Polypodium vulgare.	Πολυποδιον.
Populus alba.	Λευκη.
Populus nigra.	Αιγειρος.
Populus tremula.	Κερκις.
Porrum vineale.	Πρασον Αμπελοπρασον.
Potamogeton natans.	Ποταμογειτων.
Potentilla reptans.	Πενταφυλλον.

SA

Ruta graveolens. Πηγανον ορεινον.

S

SAGITTARIA sagittifolia. Φλεον.
Salix alba. Ιτια λευκη.
Salix Ægyptiaca. Ελαια Ελαιαγνος.
Salix amygdalina. Ιτια μελαινα.
Salix helix. Ιτια ελικη.
Salix pentandra. Οισος.
Salsola Tragus. Δρυπις.
Salsola Tragus. Τραγος.
Salvia Æthiopis. Αιθιοπις.
Salvia horminum. Ορμινον ημερον.
Salvia officinalis. Ελελισφακον.
Salvia officinalis. Σφακελος.
Salvia pratensis. Ορμινον αγριον.
Salvia Sclarea. Βακχαρις.

SC

Sambucus Ebulus. Ακτη Χαμαιακτη.
Sambucus nigra. Ακτη δενδρωδης.
Santolina Chamæcypariſsus. Αβροτονον θηλυ.
Saponaria Ocymoïdes. Ωκιμοειδες.
Satureia capitata. Θυμος.
Satureia hortensis. Θυμβρα σπαρτη.
Satureia thymbra. Θυμβρα αγρια.
Saxifraga Cotyledon. Κοτυληδων ετερον.
Scabiosa Succisa. Πυκνοκομον.
Scandix cerefolium. Ενθυσικον.
Scandix cerefolium. Ορεοσελινον.
Scandix odorata. Μυρρα.
Scandix Pecten. Σκανδυξ.
Scilla maritima. Σκιλλα.
Scilla unifolia. Βολβινη.
Scirpus lacustris. Ολοσχοινος.
Scirpus holoschœnus. Σχοινος. Sp. 3.

RI

Ranunculus thora. Ακονιτον ϖαρδαλιαγχες.
Raphanus Raphanistrum. Λαμψανη.
Raphanus sativus. Ραφανις.
Reseda luteola. Καταναγχη.
Reseda Phyteuma. Φυτευμα.
Rhamnus Alaternus. Αφαρκη.
Rhamnus Alaternus. Φιλυκη.
Rhamnus lotus. Λωτος.
Rhamnus lycioïdes. Ραμνος μελαινα.
Rhamnus oleoïdes. Ισϖοφαες.
Rhamnus paliurus. Ραμνος. Sp. 3.
Rheum Rhaponticum. Ρα.
Rhodiola rosea. Ροδια ριζα.
Rhus coriaria. Ρυς.
Rhus Cotinus. Κοκκυμηλεα.
Ribes uva crispa. Ισος.
Ribes uva crispa. Σταφυλη.
Ribes uva crispa. Κυνοσβατος ακανθα.

RU

Ricinus communis. Κικι.
Rosa canina. Κυνοσβατος.
Rosa centifolia. Ροδον εκατοντοφυλλον.
Rosa Gallica. Ροδον.
Rosmarinus officinalis. Λιβανωτις.
Rubia tinctorum. Ερυθροδανον.
Rubus Cæsius. Βατος Χαμαιβατος.
Rubus fruticosus. Βατος ορθοφυης και υψος εχων.
Rubus Idæus. Βατος Κυνοσβατος.
Rumex acetosa. Λαϖαθον Οξαλις.
Rumex acutus. Λαϖαθον Οξυλαϖαθον.
Rumex Alpinus. Λαπαθον Ιππολαπαθον.
Rumex aquaticus. Λαπαθον Ιππολαπαθον.
Rumex patientia. Λαπαθον κηπευτον.
Rumex scutatus. Λαπαθον αγριον.
Ruscus aculateus. Μυρσινη αγρια.
Ruscus Hippogloſsum. Ιπποyλωσσον.

Ruta graveolens. Πηγανον ορεινον.

S

SAGITTARIA sagittifolia. Φλεον.
Salix alba. Ιτεα λευκη.
Salix Ægyptiaca. Ελαια Ελαιαγνος.
Salix amygdalina. Ιτεα μελαινα.
Salix helix. Ιτεα ελικη.
Salix pentandra. Οισος.
Salsola Tragus. Δρυπις.
Salsola Tragus. Τραγος.
Salvia Æthiopis. Αιθιοπις.
Salvia horminum. Ορμινον ημερον.
Salvia officinalis. Ελελισφακον.
Salvia officinalis. Σφακελος.
Salvia pratensis. Ορμινον αγριον.
Salvia Sclarea. Βακχαρις.

Sambucus Ebulus. Ακτη Χαμαιακτη.
Sambucus nigra. Ακτη δενδρωδης.
Santolina Chamæcyparisſus. Αϐροτονον θηλυ.
Saponaria Ocymoïdes. Ωκιμοειδες.
Satureia capitata. Θυμος.
Satureia hortensis. Θυμϐρα σπαρτη.
Satureia thymbra. Θυμϐρα αγρια.
Saxifraga Cotyledon. Κοτυληδων ετερον.
Scabiosa Succisa. Πυκνοκομον.
Scandix cerefolium. Ενθυσικον.
Scandix cerefolium. Ορεοσελινον.
Scandix odorata. Μυρρα.
Scandix Pecten. Σκανδυξ.
Scilla maritima. Σκιλλα.
Scilla unifolia. Βολϐινη.
Scirpus lacustris. Ολοσχοινος.
Scirpus holoschœnus. Σχοινος. Sp. 3.

SE

Scirpus mucronatus.	Οξυσχοινος.
Scirpus Oloschœnus.	Ολοσχοινος.
Scolymus hispanicus.	Σκολυμος.
Scorpiurus sulcata.	Σκορπιοειδης.
Secale Cereale.	Ολυρα.
Secale cereale hybernum.	Τυφη ετερα.
Sedum acre.	Αειζωον ετερον.
Sedum Cepæa.	Κηπαια.
Sedum reflexum.	Αειζωον μικρον.
Sedum Telephium.	Τηλεφιον.
Sempervivum arboreum.	Αειζωον μεγα.
Sempervivum tectorum.	Αειζωον μεγα.
Senecio Doria.	Πανακες Χειρωνιον.
Senecio vulgaris.	Ηριγερον.
Serapias helleborine latifolia.	Επιπακτις.
Serratula arvensis.	Κιαιωθος.
Sesamum orientale.	Σησαμη.
Seseli elatum.	Δαυκες Κρητικος.

SM

Seseli Hippomarathrum.	Μαραθρον αγριον.
Seseli saxifragum.	Τραγιον.
Seseli tortuosum.	Σεσελι Μασσαλεωτικον.
Seseli Turbith.	Θαψια.
Sida Abutilon.	Αλθαια. Sp. 2.
Sideritis hirsuta.	Σιδηριτις Ηρακλεια.
Sideritis Syriaca.	Σταχυς.
Sinapis arvensis.	Λαμψανη.
Sinapis nigra.	Σινηπι.
Sison Ammi.	Αμμι.
Sison Amomum.	Αμωμον.
Sison Amomum.	Σισων.
Sisymbrium Nasturtium.	Σισυμβριον.
Sisymbrium sylvestre.	Ευζωμον αγριον.
Sium latifolium.	Σιον.
Sium Sisarum.	Σισαρον.
Smilax aspera.	Σμιγαξ τραχεια.
Smyrnium olusatrum.	Σμυρνιον.

TA

Solanum Melongena.	Στρυχνος. Sp. 1.
Sonchus oleraceus.	Ανδρυαλα.
Sonchus oleraceus.	Σογχος.
Sorbus aucuparia.	Οη αρρην.
Sorbus domestica.	Οη θηλεια.
Sparganium erectum.	Βȣτομος.
Sparganium erectum.	Σπαργανιον.
Spartium junceum.	Σπαρτιον.
Spartium spinosum.	Ακακια Ποντικη.
Spiræa salicifolia.	Σπειραια.
Stachys Germanica.	Σταχυσ.
Statice Limonium.	Λειμωνιον.
Stipa tenacifsima.	Λινοσπαρτον.
Styrax officinalis.	Στυραξ.
Symphytum tuberosum.	Συμφυτον. Sp. 2.
Symphytum officinale.	Συμφυτον. Sp. 1.

T

TAGETES erecta.	Οθοννα.

TH

Tagetes patula.	Αργεμωνη.
Tamarix Gallica.	Μυρικη αγρια.
Taxus baccata.	Μιλος.
Taxus baccata.	Σμιλαξ (arbor.)
Teucrium Chamæpitys.	Ανθυλλις.
Teucrium Chamæpitys.	Χαμαιπιτυς.
Teucrium fruticans.	Παιδερως.
Teucrium Chamædrys.	Χαμαιδρυς.
Teucrium Iva.	Χαμαιπιτυς.
Teucrium Polium.	Πολιον.
Teucrium Scordium.	Σκορδιον.
Thalictrum flavum.	Θαλικτρον.
Thapsia Asclepium.	Ασκληπειον.
Theligonum Cynocrambe.	Κυνοκραμϐη.
Thlapsi arvense.	Θλασπι. Sp. 1.
Thuia occidentalis.	Θυια.
Thymus Acinos.	Ακινος.
Thymus Mastichina.	Ελενιον.

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